UNIT 1 QUALITY: CONCEPT AND SIGNIFICANCE

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Structure

1.0 INTRODUCTION

For more than two decades "quality" and "quality management systems" have been leading buzzwords in the business world. Numerous consultants have built their careers around these topics, and quality issues in business have been responsible for the development of new organizations and even industries, for instance, the American Society for Quality and Six Sigma consulting. The notion of quality in business focuses on the savings and additional revenue that organizations can realize if they eliminate errors throughout their operations and produce products and services at the optimal level of quality desired by their customers. Errors can take almost any form—for example, producing the wrong number of parts, sending

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bank statements to customers who have already closed their accounts or sending an incorrect bill to a client. All of these errors are very common, and the costs incurred seem minimal. But over time when mistakes are repeated the costs add up to a significant amount, so eliminating errors can result in significant increases to the bottom line of a business.

Quality management, also known as quality control, is a system used by all types of businesses all around the world. This type of management system can help any type of business provide consumers with the best product and/or service possible by coordinating its activities, which leads to an increase in its effectiveness and efficiency. There are many different types of quality management systems utilized by businesses. Through these types of systems, a business can monitor and measure the quality of its products and/or services being offered to consumers. An effective quality management system helps a business to increase its competitive edge, augment its organizational development, highlight its customer satisfaction, and more.

Through quality management, a business finds that it is able to gain a competitive edge because it can better understand all of its operational processes. Understanding operational processes enables a business to improve them, which, in turn, allows for innovation and enhancing of the quality of its products and/or services being offered to consumers. Some of the most commonly utilized quality control process improvement tools are process mapping, brainstorming, scatter diagrams, control charts, and force field analyses. These tools help an organization's employees to stay creative and productive, which increases a business' competitive edge. It is important for a business to carefully choose what quality management tools it uses, as different types of businesses will use different types of systems.

Organizational development is improved for businesses that utilize a quality control system. This increase in development stems from all organizational employees staying aware of their organization's product and/or service quality. The more focused and educated an organization's employees stay about quality, the higher quality the organization's products and/or services will be. Quality management systems also lead to quality planning, which leads to an improvement in employee communication skills, a broadening of employee skills and knowledge, as well as an increase in organizational flexibility. These systems also improve an organization's internal customer/supplier relationships.

One of the most valued aspects of utilizing a quality management system is that it leads to an increase in customer satisfaction. This type of system increases a business' ability to reduce the waiting time of its consumers, improve its delivery and shipping methods, as well as increase its customer loyalty. The higher the rate of customer loyalty a business has, the higher its profit levels will be. A quality control system is able to analyze the experiences of existing and past customers to meet existing and potential customers' expectations. Meeting customers' expectations is the key element in providing superb customer satisfaction.

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Case Study of Papa John's: Quality as a Core Business Strategy

Would you recognize a Papa John's pizza sign from a distance? Many people would, given the distinctive green and red emblem and logo, which is designed to attract attention and place the store in a flattering light. Papa John's began as a small, one-store operation that evolved out of the need to rescue a failing tavern. Quick success meant expansion to 4 stores in two years and 23 stores in five years. Currently, Papa John's plans to complete more than 2,000 units with over $1 billion in sales in a mature industry most felt were saturated with competitors.

In order to survive in a highly competitive market place, Papa John's needed to develop a distinctive voice. One clear message was needed to penetrate every aspect of the business, including hiring decisions, selection of locations, and all business strategies and tactics.

At the strategic level, each of the big three pizza companies-Pizza Hut, Domino's, and Little Caesar's-holds a distinct niche in the market. Pizza Hut offers menu variety and a dine-in atmosphere; Domino's emphasizes quick delivery, and Little Caesar's focuses on price. To establish a contrasting theme, Papa John's strongly centers its efforts on quality, including the overall theme of "Better Ingredients, Better Pizza ". Owner John Schnatter makes a concerted effort to keep his product "simple, consistent, and focused", by making personal visits to as many locations as possible each year.

In selecting locations, Papa John's tries to purchase prime real estate in prominent locations and then counts on its bright signs and logos to attract attention. As one manager in the organization stated, "We think the customer cares where a state is " the effort to find choice locations reemphasizes quality, in every aspect of the organization's operation.

Papas John's hires employees based on their compatibility with an overall organizational attitude. Individuals are selected who are "warm, friendly, and nice," according to one human resource officer. As Susie Southgate-Fox, Vice

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President of Human Resources, put it, " we can teach people about food and wine, and how to carry things, but we can't teach someone how to be warm and friendly. These people are not just serving food. They make the difference in whether someone will return to this restaurant,"

The pizza itself is the major focus of the quality campaign. The ingredients are developed by key centralized commissaries that provide fresh dough and sauce, with a careful eye on consistency and quality campaign. The final product always includes a small tub of garlic but is getting "more bang for the buck," according to Gerry Durnell, editor and publisher of Pizza Today. Papa John's patrons expect quality at a reasonable price. There are no in store salad bars that add to costs, and the menu is limited to pizza, bread-sticks, cheese sticks, and soft drinks.

The Papa John's story is reprinted on the walls of many of its stores. Take-home menus not only circulate to retail customers but also find their way into other businesses, where employees can use them to order a quick, high quality lunch. The menus have the same colors and logo as the store signs and delivery vehicles that carry the product to homes and other business. The hats and uniforms workers wear also carry the logo and emphasize the theme.

Advertisements, employees, locations, logos, hats, uniforms, take-home menus, delivery vehicles, suppliers, and the product itself all combine to form an integrated advertising and marketing communications theme emphasizing quality. The theme works, as witnessed by the firm's phenomenal growth and astounding success. Customers know what they're getting when they order Papa John's pizza.

In the future, Papa John's intends to continue its long-term expansion plans by opening more than 1,000 international units, beginning with stores in Mexico and Canada. Even so, the goal still remains to provide quality, as owner-manager Schnatter states.

Questions to Discuss

1. How Papa John's increase their business size and now what are their plans?
2. For doing business well, now what is needed for Papa John's?
3. Who are the competitors of Papa John's and for increasing sales and customer satisfaction what steps have been taken by them?
4. For quality campaign what are the necessary things for focusing and according to pizza today what is the present condition of Papa John's?
5. What are the combinations of integrated advertising of Papa John's and what is their next plan?

Credit: *International Business-CUSAT*

1.1 UNIT OBJECTIVES

After going through this unit, you will be able to:

- Discuss the concept and significance of quality
- Discuss quality as customer delight and meeting standards
- State the difference between actual and perceived quality
- Describe the concept of total quality
- Explain the need and functions of quality
- Know the philosophy of quality
- Describe the concept of six sigma
- State the contribution of key quality gurus.

1.2 MEANING AND CONCEPT OF QUALITY

In the beginning, a high-quality product was understood as one that is stronger and is, in general, more durable than other products. In some cases, this is a good definition of a quality product, but not always. A good fuse (circuit breaker), for example, is not one that lasts longer during periods of high current or voltage. So the quality of a product is the degree to which the product meets specifications. This definition of quality is also true for the service sector industry. In fact, today, quality is more visible in the service sector such as hospitals, restaurants, banks, etc. The health of organizations producing physical commodities thrives not only on manufactured products but also on the services (annual maintenance, defect replacement, product updates, etc.). In today's society, organizations like insurance companies do not produce anything physical yet they are crucial in providing security to the commodities (e.g., vehicle) acquired by an individual. Increasingly, the definitions of quality include an added emphasis on meeting these new needs of an individual. Several pioneers of quality have provided various definitions of quality. Feigenbaum defines quality as "The total composite product and service characteristics of Engineering, Manufacturing, Marketing and Maintenance through which the product and service in use meet the expectation of the customer".

According to Juran

(i) Quality consists of those product features which meet the needs of customers and thereby provide product satisfaction.

(ii) Quality consists of freedom from deficiencies. "Product" is the output of any process. It consists of mainly goods, software and services.

A "product feature" is a property which is possessed by a product and which is intended to meet certain customers' needs. A "customer" is someone who is impacted by the product. Customers may be external or internal. External customers

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are impacted by the product but are not members of the company which produces the product. External customers include clients who buy the product, government regulatory bodies, the public etc. Internal customers are members of the company who require the product for further processing or in-house use. Some other definitions of quality quoted in the literature are as follows:

- According to ANSI/ASQC Standard A3-1987 (draft), quality means "The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs."
- The European Organization for Quality Control Glossary (1981) defines quality as "The totality of features and characteristics of a product or service that bear on its ability to satisfy a given need. For example, with manufactured products quality is mainly determined by quality of design and quality of manufacture."
- The Soviet encyclopedia defines quality as follows: "Quality of products is the aggregate of properties of a product determining its ability to satisfy the needs it was built to satisfy."

The concept of quality has evolved from one that is produced (product) or provided (service) by an organization to an individual or society. Quality is a demand of customer either internal or external. A product can be said to possess a good quality if it fulfills the following requirements:

Fitness for Purpose

The product or service fulfils the purpose for which it has been produced or provided.

Conformance to Requirements

The product performs satisfactorily in an application intended by the user.

Grade

The product possesses distinguishing features in terms of appearance, performance, durability, safety, affordability and maintainability.

Degree of Performance

The product scores over competitive products of equivalent grade, based on comparative test by customers.

Degree of Excellence

The product gains a value derived from functions performed with the product, the timeliness of a product's availability, aesthetics associated with ownership, quality of performance and its cost.

With the principle that "customer is the king", the producer or service provider strives to meet the expectations of the customer. From the producer's point of view, quality must be observed in the aspects of designing, conformance and performance. In the next sections, we shall study how quality is observed in the above three areas in the product industry. The implications of quality in the service sector shall be discussed side by side.

1.3 QUALITY AS CUSTOMER DELIGHT

Customer delight is a key to success. Customer delight refers to if the company reaches beyond the expectations of the customer and the customer exceeded quality, then the customer is delighted. Customer cannot be delighted if he/she is not satisfied, the factor of delightness comes after the factor of satisfying consumer need. The delighted customer is more valuable for the company as it will help the companies to compete with the competitors. A delighted customer finds the largest perceived value-cost gap. Customers are moving towards services and quality. Delighted customers can do a lot in the favour of a company.

Quality management is essential for customer satisfaction which eventually leads to customer loyalty. How do you think businesses run? Do businesses thrive only on new customers? It is important for every business to have some loyal customers. You need to have some customers who would come back to your organization no matter what. For example if you got some problems in your previous handset, you will buy the next handset from a different company or class. Customers would return to your organization only if they are satisfied with your products and services. Make sure the end-user is happy with your product. Remember, a customer would be happy and satisfied only when your product meets his expectations and fulfills his needs. Understand what the customer expects from you. Find out what actually his need is. Collect relevant data which would give you more insight into a customer's needs and demands. Customer feedback should be collected on a regular basis and carefully monitored. Quality management ensures high quality products and services by eliminating defects and incorporating continuous changes and improvements in the system. High quality products in turn lead to loyal and satisfied customers who bring ten new customers along with them. Do not forget that you might save some money by ignoring quality management processes but ultimately lose out on your major customers, thus incurring huge losses. Quality management ensures that you deliver products as per promises made to the customers through various modes of promotions. Quality management tools help an organization to design and create a product which the customer actually wants and desires.

Delighting a customer involves finding ways to offer superb products and providing services that make the customer feel special. A customer delight

philosophy requires management support, and a trained, empowered, and motivated workforce.

Different sectors have found innovative ways of delivering a little extra value. Here are some simple ways that others have used to delight their customers:

From the hospitality industry:

- Warm chocolate chip cookies in mid-afternoon
- Apples on your front desk counter
- Answering the phone using the guest's name
- Frequent stay awards
- Concierge services

From Customer Support Call Centers:

- Quick response/ quick resolution
- Cordial, knowledgeable, empathetic and helpful service
- "Is there anything else we can do for you today?"

From the retail industry:

- Free maintenance offers at car dealerships
- Cordial, knowledgeable and helpful assistance
- Unadvertised specials, discounts
- Calling customers when the items they usually buy arrive at the store

From the shipping industry:

- Delivery dates and package tracking available on the internet

From manufacturers and wholesalers:

- Free or inexpensive training on products and services
- Superb customer support after the sale
- Easy access to product information
- Providing customers with marketing opportunities by partnering
- Facilitate obtaining extra information/support
- Helping customers improve their operations

1.3.1 Importance of Customer Delight

The most successful businesses have discovered a formula that goes beyond product and service. Their business is providing delight to their customers by understanding their specific personal interests, anticipating their needs, exceeding their expectations,

and making every moment and aspect of the relationship a pleasant or better yet, an exhilarating experience. These days, it takes a lot more than satisfaction to stand out from the pack and keep clients/customers eagerly coming back for more.

1.3.2 How to Keep Customer Delight?

When it comes to marketing, the ultimate target of every company is to delight the customer. The basic reason is to stay in the market and earn profit as well. Companies can earn profit and can stay in the market by satisfying customer needs and also by delighting them. The customer can be more loyal to the company products just by the fulfilment of the expectations by the customers, so that, companies apply such tools to delight the customers. The tools are defined as follows:

- **Complaint and suggestion systems:** Companies create such systems that the customer can evaluate the company products and give the feedback, not only the positive feedback but the negative feedback too. The companies are also looking for the better suggestions by the customers.
- **Customer satisfaction surveys:** Companies also do the surveys for the valuation of its products and services. The companies can use the survey methods as questionnaire and face-to-face interviews or emails. Now customers also can gives views on online servicing.
- **Ghost shopping:** The customer is also delighted by such shopping as just for experience if the product is a quality product the customer can be delighted.
- **Lost customer analysis:** If the customer is lost, the companies can do an analysis on the customers. The company can view the reasons of losing the customers. The company should analyse the satisfied customers and the dissatisfied customers also.

1.3.3 Customer Satisfaction vs. Customer Delight

It is not enough that we satisfy the customer, basically customer delight has an importance in managing the quality of product and assumption state (Edwards Deming 1986).Customer delight and satisfaction are not the same because delight means to take pleasure and satisfaction means how we agree that the person will purchase the product or not, so both gives different meanings. When the product is the central target of the product function, we can say the product is the necessary attribute which must be provided. These features satisfy the customers. Some time the customer is not satisfied with the product features, as the example: the availability of gasoline is a must, cleanliness of the rest of the room satisfies, whereas a concession area might be a delight. Oliver (1997) described the two concepts of behavioral consumption and psychological consumer behavior. Psychology literature includes positive emotion and negative emotion which is the combination of joy and surprise

trait and refers to delight. Behavioral concept consists of the satisfaction and the performance through which a consumer judges, these products. In short, a delighted customer is more likely to remain the customer of an organization then those who are merely satisfied.

1.4 QUALITY AS MEETING STANDARDS

A quality system is composed of the standards and procedures that are developed to ensure that the level of quality desired is repeated in every unit of a product or service. This portion of the quality system is very concrete and can be measured and managed. Before you start, your organization should establish a core team to carry the performance system design process forward. The eight steps of the design process are:

1. Understand and map all business structures and processes. This forces employees involved in designing a performance measurement system to think through and understand the entire organization, its competitive position, the environment in which it operates, and its business processes. This will also allow for complete understanding of customer touch points and how the different operations in the organization affect the customer's perception of quality.
2. Develop business performance priorities. The performance measurement system should support the stakeholders' requirements from the organization's strategy through its business processes. This order of priorities must be in place well before the process enters the actual design phase.
3. Understand the current performance measurement system. Every organization has some kind of measurement system in place. For this reason, there are basically two ways to approach the design and implementation of a new performance measurement system. Either you can scrap the old system and introduce a new one as a replacement, or you can redevelop the existing system. Both approaches can work, but the former approach is more likely to lead to trouble. People will cling to the old measurement system and either use both systems simultaneously or use the old one and simply go through the motions of the new one. You can eliminate this outcome by taking the second approach.
4. Develop performance indicators. The most important element of a performance measurement system is the set of performance indicators you will use to measure your organization's performance and business processes. This is the point in the design process where the top-down approach meets the bottom-up design approach and where the broad masses of the organization become involved.

The purpose of this step is to develop the performance measurement system with an appropriate number of relevant and accurate performance indicators.

5. Decide how to collect the required data. Developing perfect performance indicators that will tell you everything you ever wanted to know about what goes on in your organization is one thing, but being able to collect the data required to calculate these performance indicators is a completely different matter. This issue must initially be addressed during the development of the performance indicators so that you avoid selecting those that can never actually be measured. There will be trade-offs of cost and time versus the benefits of collecting data, but a likely middle ground between perfect data/high cost and no data/no cost will be found.
6. Design reporting and performance data representation formats. In this step, you decide how the performance data will be presented to the users; how the users should apply the performance data for management, monitoring, and improvement; and who will have access to performance data. After you finish, you should have a performance measurement system that has a solid place in your organization's overall measurement based management system.
7. Test and adjust the performance measurement system. Your first attempt at the performance measurement system will probably not be perfect—there are bound to be performance indicators that do not work as intended, conflicting indicators, undesirable behavior, and problems with data availability. This is to be expected. In this step you should extensively test the system and adjust the elements that do not work as planned.
8. Implement the performance measurement system. Now it's time to put your system to use. This is when the system is officially in place and everyone can start using it. This step involves issues such as managing user access, training, and demonstrating the system.

The basic requirement of industrial production is to manufacture, as cheaply as possible, products that satisfy consumer demand. Ways of reducing costs include purchasing materials cheaply and making use of cheap labor. These are management devices, not technical ones. Technical measures might include lowering materials consumption per product unit or raising per-capita value-adding productivity.

Raising productivity through technology basically involved using scientific laws and principles in the production process. Modern industry is based on scientific progress, and the application of science to manufacturing has enabled the mass production of sophisticated products that were previously unimaginable. Industrial production is achieved through a wide-ranging application of known scientific laws and principles in such diverse fields as mechanics, thermodynamics, strength of materials, electro-magnetic, vibration science, metallurgy, chemistry, biology, and so on.

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Industrial production efficiency is determined by how skillfully these laws and principles are applied to achieving specific objectives. Technical standards embody the most efficient methods from all those methods technically feasible at any given time. Although they may change when a more efficient method is discovered, until this happens they represent the best methods known.

Although work can still be accomplished even without adhering to standards, failure to do so inevitably leads to lowered efficiency. Trying to maintain efficiency also has an effect on quality. A technical standard enshrines current best practices; deviation from it can cause either a drop in efficiency or deterioration in quality. Thus, work must be carried out in accordance with the standards if the specified quality at maximum efficiency is to be produced.

Although human beings can discover and make use of the laws of nature, they cannot invent or change them. Utilizing natural laws in industry therefore means manufacturing in accordance with these laws. Work that fails to take them into account is bound to result in harm. The process of manufacturing a given product inevitably defines itself in the course of pursuing greater efficiency. A process created in this way then becomes a standard, and many standards relating to design, manufacturing technology, and production are of this type.

While standards based on scientific laws and principles are naturally defined by the pursuit of quality and efficiency, some standards are artificial conventions deliberately imposed by human beings. There is no natural law that makes such standards mandatory; people formulate and enforce them because they find it convenient to do so for social or business reasons. For example, it really does not matter whether people drive on the right or left side of the road, but there would be trouble if this was used as a reason for not stipulating which side people have to drive on. One side or the other must be specified. Various systems of weights and measures also exist, such as the metric, imperial, and ancient Japanese systems. It would be convenient if the same system was used all over the world, and most countries have adopted the metric system as a standard. It would also be convenient if electricity supplies all over the world used the same voltage and frequency.

Standards constituting social or business conventions are imposed for reasons of convenience or safety. Depending on what they cover, they are prescribed in the form of national, industrial, company, and divisional standards. Unlike standards based on natural lay, they are not absolute; with this type of standard, people are free to choose what is specified. The appropriateness of a standard of this type can be verified by weighing up the social disadvantages that would arise if it did not exist. If dispensing with such a standard would cause no problems, it is probably meaningless restriction and ought to be abolished.

1.5 ACTUAL VS. PERCEIVED QUALITY

Perceived quality is a critical element for consumer decision making; consequently, consumers will compare the quality of alternatives with regard to price within a category (Jin and Yong, 2005). According to Davis et al. (2003), perceived quality is directly related to the reputation of the firm that manufactures the product. However, National Quality Research Center or NQRC (1995) defined perceived quality as the degree to which a product or service provides key customer requirements (customization) and how reliably these requirements are delivered (reliability). Whereas Aaker (1991) and Zeithaml (1988a) said that perceived quality is not the actual quality of the brands or products, rather, it is the consumers' judgment about an entity's or a service's overall excellence or superiority. Consumers often judge the quality of a product or service on the basis of a variety of informational cues that they associate with the product. Some of these cues are intrinsic to the products, whereas others are extrinsic. As defined by Zeithaml (1988b), cues that are intrinsic concern physical characteristics of the products itself, such as product's performance, features, reliability, conformance, durability, serviceability and aesthetics. On the other hand, extrinsic attributes are the cues that are external to the products itself, such as price, brand name, brand image, company reputation, manufacturer's image, retail store image and the country of origin. Perceived quality has direct impact on customer purchase decision and brand loyalty, especially during the time customers have less or no information of the products that they are going to purchase (Aaker, 1991; Armstrong and Kotler, 2003).

The battle between perceived quality and actual quality truly is an epic struggle. Generally though, when we speak of this dichotomy, we aren't talking about trying to convince consumers that a bad product is good, as it might seem at first glance. First of all, we have to own up to the reality that as much as we like to use such labels, no products are completely good or bad; rather they all exist in varying degrees of grey between the two. And second of all, no legitimate business with any long-term success has ever set out to make an intentionally terrible product with the goal of selling it on false merit, so banish any thoughts of evil corporations trying to trick you out of your money, because it doesn't factor into our equation.

For the most part, companies worldwide are doing the best they can to create products that people want to buy. We may occasionally berate their massively misguided attempts at doing so (Pontiac Aztek, Microsoft Zune, any cell phone by LG, etc.) but if one were to step back and view these attempts objectively, even the worst products satisfy the most basic set of functions that is required of them (the Aztek could be driven, the Zune played MP3s if you could figure it out, and LG phones make calls most of the time). Typically, the quality of a mass-produced product falls somewhere between a C- and an A+, or in other words, very few companies are getting an F; spending the type of money necessary to launch something, only to find out that it doesn't work at all.

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If we continue the grading analogy, the curve is set fairly high for consumer products. It's very difficult to be the star student when everyone else in your class is getting the same grades as you, and this is why the idea of perceived quality is so important.

The auto industry is one of the best examples of how perceived quality dominates actual quality. Despite the fact that all cars share 99% of the same technology, materials, and construction techniques, car companies move mountains to establish characteristics that are perceived as being unique to each nameplate. For decades, Toyota and Honda have been seen as the ultimate quality brands. Their cars outlast any other on the road, and are light-years ahead of any other manufacturer when it comes to dependability. Want to know who beat them in JD Power's 2010 dependability rankings? Lincoln, Buick and Mercury (in addition to the slightly less surprising Porsche, and Lexus; a division of Toyota). The interesting thing is not that Honda and Toyota have been beat at their own game, but that their brand positions, and in turn, their public perceptions remain unchanged.

Toyota and Honda place numbers 1 and 2, respectively, on ALG's perceived quality rankings, despite the host of recalls both have endured over the past year, while Buick ranks 13th, Mercury falls to 20th, and Lincoln doesn't even make the cut. Over the years, both Japanese brands' claims of quality have been backed up by their customers' real world experiences, and even now that they have lost a step and their competition has leapfrogged them, that perception persists. Not even uncontested data and widely publicized problems within the two companies have made a dent in their brand armor.

But the word quality does not always have to mean the physical and functional integrity of an item. 'Quality' can be replaced with 'qualities' to mean something completely different. Within the same industry, each auto brand is trying to express a vastly different set of qualities to persuade customers to choose them over their competition. BMW is seen as one of the premier luxury brands, and its brand position as 'the Ultimate Driving Machine' cannot be rivaled by any competitor. Again, this is due to the fact that over several decades, sporty, stylish cars flowed out of Munich as though a spigot could not be turned off. However in recent years, the company's prowess has been challenged not just by predictable competitors like Mercedes Benz, Audi, and even Jaguar, but by the most unlikely of sources; Hyundai.

1.6 CONCEPT OF TOTAL QUALITY

The concept of quality has extended from physically core products into the total value delivered to customers. According to Atkinson (1993) total quality is a strategic approach to produce the best product and service possible—through constant innovation. Concentration should not be only on the production side but also on the service side of a business. General perception is that improvement in quality

Check Your Progress

1. Define quality.
2. What do you mean by customer delight?
3. State the meaning of perceived quality.

is possible only during production but total quality cannot be achieved without significant improvement in purchasing, marketing, after sales service and a host of other areas of business. Many companies may produce 'zero defect' products but the company's quality still is not right. There are other functions which can let the company down. The right product delivered at the wrong time can have catastrophic impact on both buyer and seller. A research report found that 95 percent of companies deliver their products late. This late delivery can have just as bad impact upon future buying decision as can increasing the price of the product by 50 percent.

Deming (1988) suggested that care of quality should be focused on the process rather than on the end product. After Deming proposed his ideas on quality management, people began to recognize that quality of product requires quality of "everything" in the organization. This has brought a significant change in respect of the responsibility on quality. Traditionally, the QC/QA Department was the one that bears all consequences (especially problems) resulting from quality performance of products or services delivered to customers. Today's management must realize that everybody in the organization has a contribution directly or indirectly for producing quality products or services; hence quality demands corporate responsibilities. Quality must be viewed in a total context of an organization: quality of the process, quality of the people, quality of the organizational structure and system, quality of leadership and other aspects of the organization.

Total quality is called total because it consists of 3 qualities:

- Quality of return to satisfy the needs of the shareholders,
- Quality of products and services to satisfy some specific needs of the consumer (end user) and
- Quality of life to satisfy the needs of the people in the organization.

Total quality management is defined as a continuous effort by the management as well as employees of a particular organization to ensure long term customer loyalty and customer satisfaction. Remember, one happy and satisfied customer brings ten new customers along with him whereas one disappointed individual will spread bad word of mouth and spoil several of your existing as well as potential customers.

You need to give something extra to your customers to expect loyalty in return. Quality can be measured in terms of durability, reliability, usage and so on. Total quality management is a structured effort by employees to continuously improve the quality of their products and services through proper feedback and research. Ensuring superior quality of a product or service is not the responsibility of a single member. Every individual who receives his /her paycheck from the organization has to contribute equally to design foolproof processes and systems which would eventually ensure superior quality of products and services. Total quality management is indeed a joint effort of management, staff members, workforce, and suppliers in order to meet and exceed customer satisfaction level. You can't just blame one person for not adhering to quality measures. The responsibility lies on the shoulder of everyone who is even remotely associated with the organization.

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W. Edwards Deming, Joseph M. Juran, and Armand V. Feigenbaum jointly developed the concept of total quality management. Total quality management originated in the manufacturing sector, but can be applied to almost all organizations.

Total quality management ensures that every single employee is working towards the improvement of work culture, processes, services, systems and so on to ensure long-term success.

Total quality management can be divided into four categories:

- Plan
- Do
- Check
- Act

Planning Phase

Planning is the most crucial phase of total quality management. In this phase employees have to come up with their problems and queries which need to be addressed. They need to come up with the various challenges they face in their day-to-day operations and also analyze the problem's root cause. Employees are required to do necessary research and collect relevant data which would help them find solutions to all the problems.

Doing Phase

In the doing phase, employees develop a solution for the problems defined in planning phase. Strategies are devised and implemented to overcome the challenges faced by employees. The effectiveness of solutions and strategies is also measured in this stage.

Checking Phase

Checking phase is the stage where people actually do a comparison analysis of before and after data to confirm the effectiveness of the processes and measure the results.

Acting Phase

In this phase employees document their results and prepare themselves to address other problems.

Case Study: TQM Initiatives by Carcom

'Carcom' is a supplier of automotive safety components employing around 700 staff which is located on two sites in Northern Ireland. The company was

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originally American owned but after a joint venture with the Japanese partner in the late 1980s, it was eventually bought out by the latter.

The quality initiative began in 1988-89 with a five-year plan based on the Kaizen philosophy, this concept having been picked up from the Japanese partner. This was driven by senior management in response to what they saw as increasing customer demand and operating considerations. The achievement of ISO 9001 registration in 1990 brought together processes carried out by departments which had previously been undertaken in isolation. The company is now focusing on Kaizen with the principles of improvement, customer delight, systems focus and participation. A range of quality management tools and techniques are used. A TQM steering committee is responsible for overall direction but there is also a further steering committee to oversee implementation of the Quality Improvement Teams (QITs) as well as a full time coordinator. There are teams of shop floor operators based on natural workgroups, and these tend to focus on product problems and environmental issues (such as working conditions). In contrast, Kaizen teams focus on process improvements and problem-solving workgroups are established in response to specific customer concerns (for example, warranty claims).

Senior managers stress that a long-term approach is now being taken which is in contrast to some of the programmers in the early 1980s. These former piecemeal initiatives included quality circles which had been characterized by considerable changes in personnel , with a number of champions having moved on leaving behind a flagging initiative in contrast, the company is now taking time to get the processes right and providing a central focus through quality for change. Cultural change is the aim but it is recognized that only incremental progress can be achieved and that a supportive attitude is required from management. Thus, QIT members are given extensive training and are encouraged to tackle problems which give early success and build teamwork, rather than put pressure on teams to deliver immediately on big issues.

The Impact of the TQM Initiative

While it is still early days, the initiative is already felt to have had a major impact. The management structure has been reduced by one layer, shop floor layout has been improved, and scrap rates, stock, work-in-progress and inspection times have been reduced, so too have the numbers of inspectors, whose role is now seen as one of analysts. Employee response to these changes has generally been positive, and the company has spent considerable effort in relating ‘quality’ directly to employees’ work, particularly through the use of measures which are displayed adjacent to the workstation and maintained by staff themselves. The unions were assured that there would not be job losses as a result of Kaizen, although they continue to have concerns about this and also raise the issue of

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payment for changes in job roles – particularly in relation to SpC. The company has adopted an open information policy to foster greater trust at the workplace, and business-related issues are given greater prominence at the joint works committee meetings. Management also believes that the quality initiative has led to a reduction in union influences although this was not an original objective.

The Strategic Nature of the Human Resource Function

The human resource function has emerged from a welfare to a more strategic role in recent years. This has been assisted by an MD who is regarded as a 'people's person' claiming that 'you can't divorce people from quality,' and by the appointment of a personnel director together with a new industrial relations manager. This has broadened the role of human resources and enhanced its status. The appointment of a training manager was significant, since under the previous regime little off-the-job training was conducted. Training budgets have actually increased in volume and monetary terms despite the company's recently recorded trading losses. Recruitment and selection are becoming more sophisticated as the company wishes to identify team workers.

The links between human resources and quality were made explicitly by the MD: "We cannot separate HR from TQM, and without HR the QIP (Quality Improvement Programme) will not work effectively." In addition to the issues mentioned above, the function was also seen as being important in building the people aspect into the strategic quality planning process. Addressing the problem of absenteeism, and supporting line management by helping to change employee attitudes/organizational culture. In addition, the function has provided appropriate training programmers for quality, in which there has been considerable investment in time and resources, it has counseled the mentors to the QIT, and ensured that managers communicate with staff by providing advice on the best means of doing this. Quality principles are also being developed in relation to the human resource function, with specific targets being set (for example, for absenteeism) as well as more general aims (for example, on training).

Questions

1. Analyze the links between TQM and HRM with reference both to this case study and more generally.
2. What does the case study demonstrate about the contribution a personnel/ HRM function can make to the development of TQM in an organization?
3. How might the principles of TQM be applied to a personnel function?
4. What general implications does TQM have for industrial relation?

Source: *http://www.mbaknol.com/management-case-studies/case-study-tqm-initiatives-by-carcom/*

1.7 DESIGN, INPUTS, PROCESS AND OUTPUTS

The concept of quality has evolved from one that is produced (product) or provided (service) by an organization to an individual or society. Quality is a demand of customer either internal or external.

Design

The complexity of business problems, organizations, operational and service systems, the number of variables they involve, as well as the often chaotic environment to which they are subjected make it difficult to use prior knowledge (in the form of mathematical models for example) to construct and calibrate these systems. In these cases, experimentation is an important approach to generate knowledge which can be used for effective analysis and decision making. When a product is put to use, the number of intervening variables may be too large, some of which may also be uncontrollable. Further, experiments are usually costly: there may be many variables and potentially a great deal of experimental variation and errors, making the experimental results obtained difficult to compare and analyze in a statistically acceptable manner. For such situations, experimental design, when it is properly used, provides a set of consistent procedures and principles for collecting data so that an estimate of relationships between one set of variables, called explanatory variables, and another, called dependent variables, can be performed (even if there are experimental errors).

Prior to producing a product, it is essential for the producer or manufacturer to know "what are the demands of the user? This information can be obtained by conducting surveys, past market trends, etc. (These shall be discussed in detail in a later section.) With this database, a collective assessment of user needs is made and the requirements are quantified. These quantified requirements are called 'specifications' that decide the characteristics of the product.

The quality of design is concerned with the tightness of specification for manufacture of the product. In other words, it refers to the appropriateness of the process involved with the manufacturing of the product. For example, a part with tolerance of ± 0.001 mm would be considered a better design of quality than another with tolerance of ± 0.01 mm. The manufacturer is said to deliver a good quality of design if the product performs consistently within the stipulated life span. The performance can be measured in terms of rated output, efficiency, overload capacity and continuous or intermittent operation as per specific application. The quality of design is controlled by several factors:

(a) Type of Customer in Market

The pre-requisites to the design of a product involve conducting a market survey because the taste and needs of customer vary with location, socio-economic

status and personal preference. For consumer goods, it is important to study the consuming habits, prices the customer is willing to pay and the choice of design of product i.e., its size, shape and packaging etc. For example, a 10-seater 3-wheeler would be the best choice for commuting in rural and semi-urban areas because people would share the auto rather than hire the entire vehicle, whereas a small auto-rickshaw would serve the purpose of a city commuter where he has to travel to a particular place. Thus, the priority in designing a three-wheeler for travel in rural areas is capacity whereas a city-vehicle should be compact and must run at higher speeds on city roads. Similarly, for capital goods such as heavy machineries, the decision to design for quality is governed by factors such as reliability, trouble-free service and maintainability.

(b) Profit Consideration

It is important that the manufacturer minimizes internal waste besides realizing the customer's expectation. For example, if the customer is demanding a product whose functional utility is of greater importance that the physical attributes, the manufacturer can produce a quality design without investing too much on aesthetics. Producing different grades of products, catering to various segments of customers, also contributes to increasing of the profit margin.

(c) Environmental Condition

A good design considers the effect of environment on the performance. A well-designed bus body fails to provide comfort in village roads and hilly tracks whereas a jeep makes it suitable for rough terrains and muddy roads also. Similarly, laboratory appliances often fail to perform satisfactorily in real-life situation because of absence of proper temperature, humidity, etc. Increasing research has been called for designing appliances that can perform in harsh conditions and inside factories.

(d) Special Requirements of Product

Generally, greater the requirements for strength, fatigue resistance, interchangeability of parts, etc. tighter should be the tolerance to give goods of better quality. In case of electronic items, where the breakdown of a part is unavoidable due to voltage fluctuation, designs are made to enable quick replacement.

The service sector is very sensitive to the changing needs of the customer. Often the customer would like to avail the services as per his convenience. In general, quality of design in service is viewed from the point of consumption and flexibility in service. For example, medical aid can be sought at home if patient cannot be transported to hospital. Although such design of service demands greater resources and time nevertheless it ensures that customers are delighted. The coming of personalized insurance schemes is an example of introducing flexibility in services. Such organizations deal with the customer on an individual basis. The customer himself is in charge of designing his needs (type of insurance) thereafter the organization modifies its working policy towards the customer.

Input, Process and Output

Production is carried out by a multitude of work process systems. Figure 1.1 schematically describers such a system with inflowing resources, transformation processes, and outflowing products and services. Any productive system is embedded in an economic and social environment with which it constantly interacts. In this context quality assurance has to be named as one of the many subsystems of a process system. Other subsystems are the capital and cash flow system, manpower planning, management information, and decision making systems. These subsystems are conceptually and practically interdependent and interactive. One can also distinguish work process systems with reference to the managerial levels of responsibility in a corporate production system in which the plants, branches and individuals jobs and operational systems are subordinated and integrated.

Work process systems are not restricted to manufacturing industries, where materials, parts and suppliers are transformed into higher values goods. Practically any business or enterprise uses various resources in order to sell its products and services in the market. Therefore, retail stores, theaters, insurance agencies, and so on, are all to be considered as productive systems.

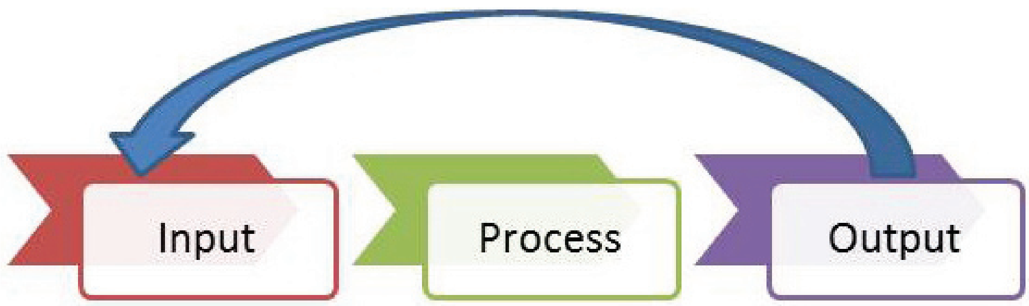


Fig. 1.1: Workflow System

Categories for work process systems that aid their conceptualization and design are, for instance:

- **Custom built:** One in which customers place their order with the producer or supplier before actual production. This enables both partners to specify quality and other conditions, to meet the customer's particular requirements.
- **Repeat orders:** One in which customers place an order for an item that is already produced or fully designed and standardized.
- **Mass production:** Product with standardized items differing form job shop production or production of custom—made items that use intermittent production processes.
- **Projects:** They describe production of large items with considerable complexity and uniqueness.

- **Services:** Production (provision) of services, normally with direct customer contact before and during production. Such services industries include transportation, public services, insurance, professional services, and the like.

These are the main types of productive systems as they occur in reality. Other differentiations can be made such as between small and large businesses. Each type of system has certain aspects in common, and these help to plan products and production more adequately. Managers can orient themselves by common aspects of relevant types and thus simplify their planning. Once the overall production has been properly established, the design of a suitable quality assurance system is also greatly enhanced. Table 1.1 gives some examples of work process systems quite familiar to us.

Table: 1.1 Examples of Work Process System

Work Process Systems	Major inputs	Assembly	Major output
Electronic assembly	Components, sub-assembltes	Assembly	T V set
Printing	Original copy	Editing, proof, printing	Book
Management in general	Corporate goals	Planning, supervising, recoding, analyzing	Directives, decisions, reports, information
Quality assurance	Quality specification; standards	Designing inspecting, training audit	Satisfactory quality image

1.8 NEED FOR QUALITY

Business success may simply be the extent to which your organization can produce a higher quality product or service than your competitors are able to do at a competitive price. When quality is the key to a company's success, quality management systems allow organizations to keep up with and meet current quality levels, meet the consumer's requirement for quality, retain employees through competitive compensation programs, and keep up with the latest technology.

The following are the key advantages maintain the quality:

- **Product quality:** Quality management ensures product quality. Some primary aspects of product quality include: performance, reliability and durability. Through the use of a quality management program, the company can produce a product that performs according to its stated promises. Use quality management

programs to improve the quality of a product and to design new products. Six sigma has a specific component called DFSS (Design for Six Sigma) which is a methodology to build Six sigma quality into a product or service.

- **Customer Satisfaction:** Quality management ensures customer satisfaction. Conduct customer satisfaction surveys to understand the qualities of the product important to the customer. Also conduct surveys with those who are not the company's customers. This will also provide insight into why these businesses use the services of the competitor. Use customer surveys to target those features of a product or service that need improvement. The quality management program provides a methodology to use to create the type of product the customer desires.
- **Increased Revenues:** Quality products and services give the company a spotless reputation in the industry. This reputation allows the company to gain new customers and sell additional products and services to existing customers. A quality management program also removes inefficient processes within the system. By removing unnecessary processes, employee productivity increases. The employee is spending less time on activities that do not contribute to the product's quality. As a result, the employee is producing more work in less time while the company has not increased the salary. Quality management programs help recapture lost money due to inefficiencies.
- **Reduce Waste:** A quality management program helps companies reduce waste. Companies that house inventory are paying for the storage, management and tracking of the inventory. The costs of having the inventory are built into the price of the product. Implementing a quality management program reduces the amount of inventory that costs the company money and occupies valuable space. Quality management means that there is a systematic approach to keeping inventories at acceptable levels without incurring waste. Work closely with suppliers to manage inventory using a Just-in-Time (JIT) philosophy. In short, a JIT inventory system helps the suppliers and manufacturer remain in close communication to become more responsive to the customer.
- **Teamwork:** Quality management systems force company departments to work as a team. Different areas of the company become reliant upon one another to produce a quality product that meets and exceeds the customers' expectations. A quality system incorporates measures that affect sales, finance, operations, customer service and marketing. The balanced scorecard is a one-stop-shop for evaluating how various departments are operating against their performance expectations. Use the balanced scorecard to show how close the company is to the financial, operational, customer service and learning/growth targets.

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1.9 FUNCTIONS OF QUALITY

The following are the key functions of quality:

- Through its field contacts with users and organizations determine the quality they need.
- Research and development specialists then create a product concept so as to meet these quality needs.
- Design engineers prepare the product and material specifications which embody these qualities.
- Other engineers specify the process and equipments capable of fabricating and measuring these qualities
- Purchasing specialists buy materials and components possessing appropriate quality.
- Shop operators are trained to use the processes and equipments to build the specified quality in the products
- Inspectors determine whether the resulting products do in fact possess the required qualities
- The sales force through the distribution chain urges consumers to buy the products processing these qualities.

1.10 PHILOSOPHY OF QUALITY: OLD VS. NEW

The concept of quality has existed for many years, though it's meaning has changed and evolved over time. In the early twentieth century, quality management meant inspecting products to ensure that they met specifications. In the 1940s, during World War II, quality became more statistical in nature. Statistical sampling techniques were used to evaluate quality, and quality control charts were used to monitor the production process. In the 1960s, with the help of so-called "quality gurus," the concept took on a broader meaning. Quality began to be viewed as something that encompassed the entire organization, not only the production process. Since all functions were responsible for product quality and all shared the costs of poor quality, quality was seen as a concept that affected the entire organization. The meaning of quality for businesses changed dramatically in the late 1970s. Before then quality was still viewed as something that needed to be inspected and corrected. However, in the 1970s and 1980s many U.S. industries lost market share to foreign competition. In the auto industry, manufacturers such as Toyota and Honda became major players. In the consumer goods market, companies such as Toshiba and Sony led the way. These foreign competitors were producing lower-priced products with considerably higher quality. To survive, companies had to make major changes in their quality programs.

Many hired consultants and instituted quality training programs for their employees. A new concept of quality was emerging. One result is that quality began to have a strategic meaning. Today, successful companies understand that quality provides a competitive advantage. They put the customer first and define quality as meeting or exceeding customer expectations. Since the 1970s, competition based on quality has grown in importance and has generated tremendous interest, concern, and enthusiasm. Companies in every line of business are focusing on improving quality in order to be more competitive. In many industries quality excellence has become a standard for doing business. Companies that do not meet this standard simply will not survive. The term used for today's new concept of quality is total quality management or TQM. Figure 1.2 presents a timeline of the old and new concepts of quality. You can see that the old concept is reactive, designed to correct quality problems after they occur. The new concept is proactive, designed to build quality into the product and process design.

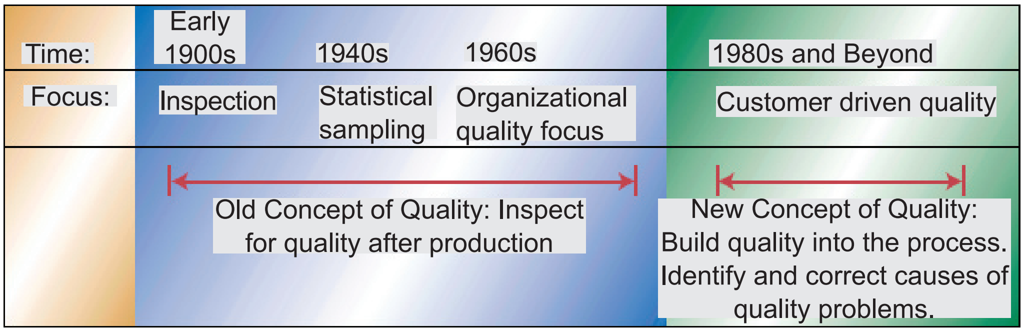


Fig. 1.2: Old vs. New Concept of Quality

The concept of QC as a distinct discipline emerged in the United States in the 1920s. At that time it was intended simply to control to limit the creation of defective items in the industrial process, which involved inspection of all goods. The pioneers who carried out these refinements included: Shewhart, Deming, Juran, Crosby.

Several management theories expanded this idea and started using statistics to control processes, to limit variations and improve the quality.

1.11 QUALITY AS A PROBLEM, AS A CHALLENGE AND AS A DELIGHT

The concept of quality may be considered as a problem, a delight and a challenge.

Quality as a Problem

Major problems faced by a company while measuring the cost of quality improvement are enumerated below:

- The difficulty in measuring and quantifying certain quality parameters such as the customer loyalty, staff commitment, product reputation, true cost of errors in

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the organisatoin which are not always recorded or the improved workmanship of the properly trained employees.

- There is apparently subjective nature of classification of quality costs. Therefore, the importance of establishing a consistent company– wide view of the various quality costs increases.
- The technical – accounting problems of a cost measurement system which by definition is incomplete (not all costs within an organisatoin are classified as quality costs) and therefore, does not produce a balanced account which would permit validation.
- The difficulty in apportioning overheads across the quality cost categories. This represents a fundamental problem as the overhead activities (such as management time spent on correcting errors and troubleshooting) are often the way quality costs. The moves towards activity-based system may improve this particular difficulty.

Despite these problems, the ongoing measurement of the cost of quality is an important element of quality development. The reporting format and frequency are generally company-specific although certain standardized approaches are emerging.

Quality as a Challenge

'Citius, Altius, Fortius meaning 'Faster, Higher, Stronger', engraved on Olympic medals, symbolized the spirit of competition, seeking an ever greater excellence in man's achievements. The 'search for excellence' is not new, however; it is inbred in a Darwinian philosophy for the survival of the fittest. Quality is thus an expression of this excellence, which leads one firm's product to dominate another, and to guarantee its survival by establishing a new standard of quality. Over time, excellence creates an image of quality. This is how English clothes, German cameras, French wines and cheeses, and so on, have become marks of excellence. In this context, quality is a perpetual challenge which results both from a process of perpetual improvement and a domination over other, similar products.

Of course, new technology can alter such domination. American cars, once an image of excellence, have been gradually been replaced by Japanese cars; for some in the TJS, French wine is gradually being replaced by Californian wine, etc. in this sense, quality is a mark of excellence, persistent and maintained over long periods of time. Such excellence is, of course, a function of habits, culture and values, and may thus vary from person to person and from time to time.

Quality as Delight

In today's ultra competitive business environment merely meeting customer expectations is not enough. In order to effectively differentiate themselves from the competition, service providers need to focus on exceeding customer expectations

to create customer delight and create a pool of loyal customers. Therefore, when deciding on a service delivery design, it is imperative for the service provider to consider the targeted customer base and their needs and expectations. This will help in developing a service design that will help the provider to effectively manage customer expectations leading to customer delight. Customer delight is a wonderful thing to achieve. The customer does the reverse of spreading the bad news and tells his friends of his good judgment in finding this special service (as we've seen he won't tell quite as many; good news doesn't travel as far as bad but the good feeling may last). The supplier and his team feel good about their work being valued. But it is a very delicate emotion. He cannot be thrilled every time, but he will miss it if we revert to ordinary service. We have raised his expectation and we have no choice but to set our sights higher and do something better. This is the true power of customer-orientation: to please the customer, continuous improvement is mandatory.

1.12 SIX SIGMA CONCEPT

Six sigma is a business management strategy which aims at improving the quality of processes by minimizing and eventually removing the errors and variations. The concept of six sigma was introduced by Motorola in 1986, but was popularized by Jack Welch who incorporated the strategy in his business processes at General Electric. The concept of six sigma came into existence when one of Motorola's senior executives complained of Motorola's bad quality. Bill Smith eventually formulated the methodology in 1986.

Quality plays an important role in the success and failure of an organization. Neglecting an important aspect like quality, will not let you survive in the long run. Six sigma ensures superior quality of products by removing the defects in the processes and systems. Six sigma is a process which helps in improving the overall processes and systems by identifying and eventually removing the hurdles which might stop the organization to reach the levels of perfection. According to sigma, any sort of challenge which comes across in an organization's processes is considered to be a defect and needs to be eliminated

Organizations practicing six sigma create special levels for employees within the organization. Such levels are called as: "Green belts", "Black belts" and so on. Individuals certified with any of these belts are often experts in six sigma process. According to six sigma any process which does not lead to customer satisfaction is referred to as a defect and has to be eliminated from the system to ensure superior quality of products and services. Every organization strives hard to maintain excellent quality of its brand and the process of six sigma ensures the same by removing various defects and errors which come in the way of customer satisfaction.

The process of six sigma originated in manufacturing processes but now it finds its use in other businesses as well. Proper budgets and resources need to be allocated for the implementation of six sigma in organizations.

Following are the two six sigma methods:

- DMAIC
- DMADV

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DMAIC focuses on improving existing business practices. DMADV, on the other hand focuses on creating new strategies and policies.

DMAIC has Five Phases

(i) D - Define the problem. In the first phase, various problems which need to be addressed to are clearly defined. Feedback is taken from customers as to what they feel about a particular product or service. Feedback is carefully monitored to understand problem areas and their root causes.

(ii) M - Measure and find out the key points of the current process. Once the problem is identified, employees collect relevant data which would give an insight into current processes.

(iii) A - Analyze the data. The information collected in the second stage is thoroughly verified. The root cause of the defects are carefully studied and investigated as to find out how they are affecting the entire process.

(iv) I - Improve the current processes based on the research and analysis done in the previous stage. Efforts are made to create new projects which would ensure superior quality.

(v) C - Control the processes so that they do not lead to defects.

DMADV Method

(i) D - Design strategies and processes which ensure hundred percent customer satisfactions.

(ii) M - Measure and identify parameters that are important for quality.

(iii) A - Analyze and develop high level alternatives to ensure superior quality.

(iv) D - Design details and processes.

(v) V - Verify various processes and finally implement the same.

1.13 CONTRIBUTION OF QUALITY GURUS: JURAN, DEMING AND CROSBY

To fully understand the TQM movement, we need to look at the philosophies of notable individuals who have shaped the evolution of TQM. Their philosophies and teachings have contributed to our knowledge and understanding of quality today.

1.13.1 Juran's Approach to TQM

TQM is the system of activities directed at achieving delighted customers, empowered employees, higher revenues, and lower costs (Juran and Gryna, 1993). Juran believed that main quality problems are due to management rather than workers. The attainment of quality requires activities in all functions of a firm. Firm-wide assessment of quality, supplier quality management, using statistical methods, quality information system, and competitive benchmarking are essential to quality improvement. Juran's approach is emphasis on team (QC circles and self-managing teams) and project work, which can promote quality improvement, improve communication between management and employees coordination, and improve coordination between employees. He also emphasized the importance of top management commitment and empowerment, participation, recognition and rewards.

According to Juran, it is very important to understand customer needs. This requirement applies to all involved in marketing, design, manufacture, and services. Identifying customer needs requires more vigorous analysis and understanding to ensure the product meets customers' needs and is fit for its intended use, not just meeting product specifications. Thus, market research is essential for identifying customers' needs. In order to ensure design quality, he proposed the use of techniques including quality function deployment, experimental design, reliability engineering and concurrent engineering.

Juran considered quality management as three basic processes (Juran Trilogy): Quality control, quality improvement, and quality planning. In his view, the approach to managing for quality consists of: The sporadic problem is detected and acted upon by the process of quality control; the chronic problem requires a different process, namely, quality improvement; such chronic problems are traceable to an inadequate quality planning process. Juran defined a universal sequence of activities for the three quality processes, which is listed in Table 1.2.

Juran defined four broad categories of quality costs, which can be used to evaluate the firm's costs related to quality. Such information is valuable to quality improvement. The four quality costs are listed as follows:

- Internal failure costs (scrap, rework, failure analysis, etc.), associated with defects found prior to transfer of the product to the customer.
- External failure costs (warranty charges, complaint adjustment, returned material, allowances, etc.), associated with defects found after product is shipped to the customer.
- Appraisal costs (incoming, in-process, and final inspection and testing, product quality audits, maintaining accuracy of testing equipment, etc.), incurred in determining the degree of conformance to quality requirements.
- Prevention costs (quality planning, new product review, quality audits, supplier quality evaluation, training, etc.), incurred in keeping failure and appraisal costs to a minimum.

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Table 1.2 Universal Processes for Managing Quality

Quality planning	Quality control	Quality improvement
Establish quality goals	Choose control subjects	Prove the need
Identify customers	Choose units of measure	Identify projects
Discover customer needs	Set goals	Organize project teams
Develop product features	Create a sensor	Diagnose the causes
Develop process features	Measure actual performance	Provide remedies, prove remedies are effective
Establish process controls, transfer to operations	Interned the difference	Deal with resistance to change
	Take action on the difference	Control to hold the gains

Juran's Quality Planning Road Map can be used by individuals and teams throughout the world as a checklist for understanding customer requirements, establishing measurements based on customer needs, optimizing product design, and developing a process that is capable of meeting customer requirements. The Quality Planning Roadmap is used for Product and Process Development.

Juran's Quality Trilogy and Quality Roadmap are not enough. An infrastructure for quality must be developed, and teams must work on improvement projects. The infrastructure should include a quality steering team with top management leading the effort, quality should become an integral part of the strategic plan, and all people should be involved. As people identify areas with improvement potential, they should team together to improve processes and produce quality products and services.

1.13.2 Deming's Approach to TQM

W. Edwards Deming is often referred to as the "father of quality control." He was a statistics professor at New York University in the 1940s. After World War II he assisted many Japanese companies in improving quality. The Japanese regarded him so highly that in 1951 they established the Deming Prize, an annual award given to firms that demonstrate outstanding quality. It was almost 30 years later that American businesses began adopting Deming's philosophy. A number of elements of Deming's philosophy depart from traditional notions of quality. The first is the role management should play in a company's quality improvement effort. Historically, poor quality was blamed on workers—on their lack of productivity, laziness, or carelessness. However, Deming pointed out that only 15 percent of quality problems are actually due to worker error. The remaining 85 percent are caused by processes

and systems, including poor management. Deming said that it is up to management to correct system problems and create an environment that promotes quality and enables workers to achieve their full potential. He believed that managers should drive out any fear employees have of identifying quality problems, and that numerical quotas should be eliminated. Proper methods should be taught and detecting and eliminating poor quality should be everyone's responsibility.

The means to improve quality lie in the ability to control and manage systems and processes properly, and in the role of management responsibilities in achieving this. Deming (1986) advocated methodological practices, including the use of specific tools and statistical methods in the design, management, and improvement of process, which aim to reduce the inevitable variation that occurs from "common causes" and "special causes" in production. "Common causes" of variations are systemic and are shared by many operators, machines, or products. They include poor product design, non-conforming incoming materials, and poor working conditions. These are the responsibilities of management. "Special causes" relate to the lack of knowledge or skill, or poor performance. These are the responsibilities of employees. Deming proposed 14 points as the principles of TQM (Deming, 1986), which are listed below:

1. Create constancy of purpose toward improvement of product and service, with the aim to become competitive and to stay in business, and to provide jobs.
2. Adopt the new philosophy. We are in a new economic age. Western management must awaken to the challenge, must learn their responsibilities, and take on leadership for change.
3. Cease dependence on mass inspection to quality. Eliminate the need for inspection on a mass basis by building quality into the product in the first place.
4. End the practice of awarding business on the basis of price tag. Instead, minimize total cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.
5. Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.
6. Institute training on the job.
7. Institute leadership. The aim of supervision should be to help people and machines and gadgets to do a better job. Supervision of management is in need of overhaul, as well as supervision of production workers.
8. Drive out fear, so that people may work effectively for the company.
9. Break down barriers between departments. People in research, design, sales, and production must work as a team, to foresee problems of production and in use that may be encountered with the product or service.

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10. Eliminate slogans, exhortations, and targets for the workforce asking for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, as the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the workforce.
11. (a) Eliminate work standards (quotas) on the factory floor. Substitute leadership. (b) Eliminate management by objective. Eliminate management by numbers, numerical goals. Substitute leadership.
12. (a) Remove barriers that rob the hourly worker of his right to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality. (b) Remove barriers that rob people in management and in engineering of their right to pride of workmanship. This means, inter alia, abolishment of the annual or merit rating and of management by objective.
13. Institute a vigorous program of education and self-improvement.
14. Put everybody in the company to work to accomplish the transformation. The transformation is everybody's job.

1.13.3 Crosby's Approach to TQM

Philip Bayard Crosby was born in Wheeling, West Virginia, in 1926. After Crosby graduated from high school, he joined the Navy and became a hospital corpsman. In 1946 Crosby entered the Ohio College of Podiatric Medicine in Cleveland. After graduation he returned to Wheeling and practiced podiatry with his father. He was recalled to military service during the Korean conflict, this time he served as a Marine Medical Corpsman.

In 1952 Crosby went to work for the Crosby Corp. in Richmond, Indiana, as a junior electronic test technician. He joined the American Society for Quality, where his early concepts concerning quality began to form. In 1955, he went to work for Bendix Corp. as a reliability technician and quality engineer. He investigated defects found by the test people and inspectors.

In 1957 he became a senior quality engineer with Martin Marietta Co. in Orlando, Florida. During his eight years with Martin Marietta, Crosby developed his "Zero Defects" concepts, began writing articles for various journals, and started his speaking career.

In 1965 International Telephone and Telegraph (ITT) hired Crosby as vice president in charge of corporate quality. During his fourteen years with ITT, Crosby worked with many of the world's largest industrial and service companies, implementing his pragmatic management philosophy, and found that it worked.

After a number of years in industry, Crosby established the Crosby Quality College in Winter Park, Florida. He is well known as an author and consultant and has written many articles and books. He is probably best known for his book Quality is Free (1979) and concepts such as his Absolutes of Quality Management, Zero

Defects, Quality Management Maturity Grid, 14 Quality Improvement Steps, Cost of Quality, and Cost of Nonconformance. Other books he has written include Quality without Tears (1984) and Completeness (1994).

Attention to customer requirements and preventing defects is evident in Crosby's definitions of quality and "non-quality" as follows: "Quality is conformance to requirements; non-quality is non-conformance."

Crosby's cost of quality

In his book, Crosby makes the point that it costs money to achieve quality, but it costs more money when quality is not achieved. When an organization designs and builds an item right the first time (or provides a service without errors), quality is free. It does not cost anything above what would have already been spent. When an organization has to rework or scrap an item because of poor quality, it costs more. Crosby discusses Cost of Quality and Cost of Non-conformance or Cost of Non-quality. The intention is spend more money on preventing defects and less on inspection and rework.

Crosby's four absolutes of quality

Crosby espoused his basic theories about quality in four Absolutes of Quality Management as follows:

- Quality means conformance to requirements, not goodness.
- The system for causing quality is prevention, not appraisal.
- The performance standard must be zero defects, not "that's close enough."
- The measurement of quality is the price of non-conformance, not indexes.

To support his Four Absolutes of Quality Management, Crosby developed the Quality Management Maturity Grid and Fourteen Steps of Quality Improvement. Crosby sees the Quality Management Maturity Grid as a first step in moving an organization towards quality management. After a company has located its position on the grid, it implements a quality improvement system based on Crosby's.

Crosby's Absolutes of Quality Management are further delineated in his Fourteen Steps of Quality Improvement as shown below:

- Step 1. Management Commitment
- Step 2. Quality Improvement Teams
- Step 3. Quality Measurement
- Step 4. Cost of Quality Evaluation
- Step 5. Quality Awareness
- Step 6. Corrective Action
- Step 7. Zero-Defects Planning
- Step 8. Supervisory Training
- Step 9. Zero Defects

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- Step 10. Goal Setting
- Step 11. Error Cause Removal
- Step 12. Recognition
- Step 13. Quality Councils
- Step 14. Do It All Over Again

1.14 SUMMARY

- Quality management, also known as quality control, is a system used by all types of businesses all around the world. This type of management system can help any type of business provide consumers with the best product and/or service possible by coordinating its activities, which leads to an increase in its effectiveness and efficiency
- The concept of quality has evolved from one that is produced (product) or provided (service) by an organization to an individual or society. Quality is a demand of customer either internal or external.
- Delighting a customer involves finding ways to offer superb products and providing services that make the customer feel special. A customer delight philosophy requires management support, and a trained, empowered, and motivated workforce.
- Customer delight is a key to success. Customer delight refers to if the company reaches beyond the expectations of the customer and the customer exceeded quality, then the customer is delighted.
- A quality system is composed of the standards and procedures that are developed to ensure that the level of quality desired is repeated in every unit of a product or service. This portion of the quality system is very concrete and can be measured and managed.
- Perceived quality is a critical element for consumer decision making; consequently, consumers will compare the quality of alternatives with regard to price within a category (Jin and Yong, 2005).
- Total quality is defined as the mobilization of the whole organisation to achieve quality continuously, economically and in entirety.
- Total quality management is defined as a continuous effort by the management as well as employees of a particular organization to ensure long term customer loyalty and customer satisfaction.
- The quality of design is concerned with the tightness of specification for manufacture of the product. In other words, it refers to the appropriateness of the process involved with the manufacturing of the product.
- Work process systems are not restricted to manufacturing industries, where materials, parts and suppliers are transformed into higher values goods.

Check Your Progress

Fill in the blanks

4. ……….... is defined as a continuous effort by the management as well as employees of a particular organization to ensure long term customer loyalty and customer satisfaction.
5. ……………. is a business management strategy which aims at improving the quality of processes by minimizing and eventually removing the errors and variations.
6. Quality is a ………… of customer either internal or external.
7. The ………… is concerned with the tightness of specification for manufacture of the product.
8. Quality management ensures………… .

Practically any business or enterprise uses various resources in order to sell its products and services in the market.

- Six sigma is a business management strategy which aims at improving the quality of processes by minimizing and eventually removing the errors and variations.
- TQM is the system of activities directed at achieving delighted customers, empowered employees, higher revenues, and lower costs (Juran and Gryna, 1993).
- Deming said that it is up to management to correct system problems and create an environment that promotes quality and enables workers to achieve their full potential.

1.15 KEY TERMS

- **Quality:** Quality consists of those product features which meet the needs of customers and thereby provide product satisfaction.
- **Customer delight:** Customer delight refers to if the company reaches beyond the expectations of the customer and the customer exceeded quality, then the customer is delighted.
- **Total quality:** Total quality is defined as the mobilization of the whole organisation to achieve quality continuously, economically and in entirety.
- **Quality control:** Quality control is the process through which we measure the actual quality performance, compare it with standards and take corrective actions if there is a deviation.
- **Six Sigma:** Six sigma is a business management strategy which aims at improving the quality of processes by minimizing and eventually removing the errors and variations.

1.16 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Quality consists of those product features which meet the needs of customers and thereby provide product satisfaction.
2. Customer delight refers to if the company reaches beyond the expectations of the customer and the customer exceeded quality, then the customer is delighted.
3. Perceived quality is a critical element for consumer decision making; consequently, consumers will compare the quality of alternatives with regard to price within a category (Jin and Yong, 2005).
4. Total quality management
5. Six sigma

6. Demand
7. Quality of design
8. Customer satisfaction

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1.17 QUESTIONS AND EXERCISES

Short Answer Questions

1. Define quality.
2. What do you mean by customer delight?
3. State the difference between customer satisfaction and customer delight.
4. Define perceived quality.
5. What is total quality?
6. Why quality is considered as a challenge?
7. Write a short note on six sigma concept of quality.

Long Answer Questions

1. Discuss the meaning and concept of quality.
2. Discuss the concept of quality as customer delight and meeting standards.
3. Write a note on actual vs. perceived quality.
4. What is the need for quality?
5. What are the key developments in philosophy of quality?
6. Discuss quality as a problem, as a challenge and as a delight.
7. Discuss the contribution of key quality gurus such as Juran, Deming and Crosby.

UNIT 2 STATISTICAL QUALITY CONTROL

Structure

2.0 INTRODUCTION

Many companies that manufacture products or offer services implement a standard for quality control. This is likely a way to monitor whether products meet specifications and services are satisfactory. Quality control techniques, therefore, may vary depending upon the intended measurement. Some methods of quality control include failure testing, acceptance sampling, statistical process control and analytical quality control. Company-wide quality control, software packages and customer surveys are additional tools that may be used.

Quality control is often performed by a team of professionals who use specific measurement techniques. These measures often provide information relative to a product or service to ensure it meets specifications. Without quality control techniques, a company would likely rely on standard processes without knowledge of how well they're performing.

One of the quality control techniques that may be employed by manufacturers is failure testing. This method typically puts the final product under a series of tests that determine when and how failures may occur. A set of variables, such as temperature or pressure, may be applied to reveal the product's weaknesses. In turn, members

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of the quality control team may be able to modify the product and improve points of failure before customer delivery.

Statistical quality control is a broad term that often describes probability tools used by quality professionals. For example, a company may use acceptance sampling to determine if a group of products is acceptable. The quality control manager often inspects a random sample of goods to determine quality levels of the entire lot. Based on the inspection results, the lot may then be accepted or rejected.

Statistical process control (SPC) involves similar probability methods as those of acceptance sampling. With SPC, a sample of the product is often tested to determine the success of the output process. This method does not provide quality answers with regard to the product, but rather to the method of production. For instance, product characteristics may need to meet customer specifications, and if they do not, the problem may relate to production techniques. SPC often allows the quality control team to adjust processes before goods are manufactured.

While quality control often relates to an end-product, procedures may also be needed to monitor the actual quality measurements. Such quality control techniques are often known as analytical quality control. Both technological competence and workforce intelligence may be gauged with these standards. For example, one employee may deem a product as acceptable because it meets specifications, but another may argue that its failure points are outside the intended ranges. Analytical quality control often works to safeguard the ways in which quality is measured and how control techniques are used.

In some instances, managing quality control requires company-wide participation. This often means all aspects of the organization are under scrutiny, not just the manufacturing or production segments. Managers may employ this method to ensure operations as a whole function appropriately. With company quality control, principles that are likely to influence the end-product include employee performance, data management and customer service.

Not all quality control techniques are performed manually. Some companies utilize software for quality control that often provides a visual interpretation of data. In addition, some software programs may point to alarming statistics or produce reports for a given period of time. Information related to production efficiency, product maintenance and failure occurrences may also be accessible with some software platforms. These packages often connect to existing quality measurement devices, which may allow the quality control technician to use the software for daily tasks.

Measuring the quality of a product is often tangible, with real and comparable data results. In the service industry, however, customer satisfaction is often the only way to gauge success. This sector may thus employ quality control techniques that provide information about the client's experience. Surveys and questionnaires are often used to obtain such feedback and also identify areas of improvement.

A Case Study in Quality Control

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Background

Nestle Waters, the world's leading bottled water company, has built a solid reputation on the quality and purity of its products. Established in 130 countries, with a portfolio of 72 brands, Nestle Waters continues to meet consumer needs by keeping its wide variety of products flowing through strong distribution channels.

Nestle Waters has 100 manufacturing sites operating in 38 countries. With 2007 sales of over $10 billion and a market share of 19.2%, Nestle Waters has emerged as a substantial player in the flourishing bottled water market.

Challenge

From paper-based to Electronic Data Analysis and Storage Nestle Waters' goal was to implement a system that would allow them to easily monitor, review and trend realtime quality data. Additionally, Nestle Waters needed to standardize on one solution across all of their facilities to complement their existing IT infrastructure. They were operating in both LAN and WAN environments and needed to maintain their IT framework.

Nestle Waters had been using a cumbersome paper-based system to collect and analyze data. When issues arose that required immediate attention, Nestle Waters' quality engineers had to disrupt the operators on the production line to retrieve the necessary data.

Solution

Integrate Infinity QS SPC Software with Existing IT Infrastructure.

After a thorough needs/analysis evaluation, Nestle Waters determined that Infinity QS ProFicient best satisfied their criteria for quality documentation and analysis.

The IT department played a vital role during all stages of the implementation. From an IT standpoint, the implementation focused on two separate manufacturing units—Retail Manufacturing and Home and Office Manufacturing. They spread the implementation across 16 retail sites as well as 8 home and office sites and integrated them with corporate headquarters.

Nestle Waters Retail objectives were to:

- Upgrade all factories to the latest release
- Organize the purchase of all the PCs required for the work stations.
- Image new PCs to the Nestle standard and install Infinity QS
- Ensure that the project leader had all necessary rights and permissions to access the servers

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- Nestle Waters Home and Office objectives were to:
- Format existing servers
- Install SQL databases and InfinityQS on the servers
- Purchase new PCs, image, put users in the user group and grant necessary permissions and access

As part of the organizational effort, IT planned hardware purchases in advance to ensure that servers were set up, racked and usable prior to trial production runs.

On the shop-floor, emphasis was put on location of the workstations to facilitate efficient and effective workflow.

Results: Informed, Timely Decision Making to Improve Quality

With the InfinityQS solution in place, Nestle Waters now has real-time visibility over production processes—both within the individual sites and from the corporate level across 26 factories. By tracking trends in quality data, they are able to make more accurate and timely decisions about process improvements.

Nestle Waters is using InfinityQS software to review sampling frequency optimization and in-line monitoring as well as to track the following projects:

- Cap Torque and application analysis from retail factories comparing different cap vendors
- Light weight bottle initiative to optimize process and ultimately reduce unnecessary full bottle testing
- Automatically capture air consumption process data, using analysis functions to optimize production processes.

“There are many advantages to having a computerized system that sometimes, in the fog of having this powerful tool with its many capabilities, one can over-look,” said Julie Chapman, Quality Systems Manager. “It is ultimately easier for the operator. Even with the minimal computer skills many of the operators had in the beginning, the overwhelming consensus is that they prefer using InfinityQS over a paper system.”

Other improvements have come at a practical level. “You can read the data rather than having to decipher the writing of 150 different people. The data is at your fingertips,” said Chapman.

Nestle Waters is also taking full advantage of InfinityQS’ real-time alarms. Any events that occur require assignable cause and corrective action entries. Shop floor operators review, evaluate and respond to any events that occur, before they cause quality issues.

Source: *http://www.infinityqs.com/case-studies/nestle-waters*

2.1 UNIT OBJECTIVES

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After going through this unit, you will be able to:

- Define fundamentals and objectives of Statistical Quality Control
- Describe quality planning and quality process
- Explain the meaning of Statistical Process Control (SPC) and acceptance sampling
- Describe quality assurance and Zero Defect Manufacturing.

2.2 FUNDAMENTALS OF STATISTICAL QUALITY CONTROL

Statistical quality control is the observation of variables of a manufacturing process over time and the application of statistical analysis of those variables to define operating windows that yield lower defect products. This method is used primarily for manufacturing lines rather than chemical processing equipment, though it is valid for both. Three key components of the methodology include control charts, continuous improvements and designed experiments.

Manufacturing lines often do not have a feedback loop as chemical processes might. In a chemical plant, the output of the process can be continuously monitored, and the conditions of the upstream reactants or reaction conditions can be changed to swing the process back to ideal conditions. Such instantaneous control is especially necessary for reactions that become dangerous when allowed to go to extremes. Manufacturing lines are often a series of unconnected machine operations run by a number of different operators, and inspection of the product is done at the end of the production line —off-line and often several hours or longer behind the manufacturing line itself. There is little opportunity for correction.

The major feature of statistical quality control is that instead of measuring defects and adjusting operating parameters to avoid them, the manufacturing engineer measures operating parameters to determine the statistical properties that the process exhibits over time. Variations in a parameter that are determined to fall within normal variations of the process are called common-cause variations. After studying one or more variables, the quality engineer may discover a variable that correlates well with the defect level of the product or stage of processing.

This variable is a controlling variable and is then monitored and analyzed to determine normal fluctuations, average values and control limits beyond which defect frequency increases. Control limits are initially set for most operations at plus or minus three standard deviations from the mean. They are tightened as necessary and as data are accumulated. Should variation in this variable not account for all the variation observed in the final quality of the product, additional variables are screened.

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The key variable is monitored continuously, preferably by the equipment operator. As long as the system is running within the control limits, the equipment settings are not changed. Once the parameter exceeds control limits then action is taken to bring the parameter back into limits. By consistently applying the principles of statistical quality control, the entire manufacturing line's defect rate is decreased as variation in the process is reduced.

The use of control charts by operators is often the easiest first step of a statistical quality control system, and often the work ends at this step. Ideally, the other components are implemented as well. Continuous improvement refers to efforts to bring more and more of the process under statistical quality control, including upstream activities, such as raw material sourcing and pre-acceptance testing. Designed experiments are the responsibility of the quality control engineer to determine physical explanations for the statistical variation that is observed. By having statistical data to predict outcomes, the investigation into the cause of defects is conducted in a systematic manner.

2.3 EVOLUTION AND OBJECTIVES OF STATISTICAL QUALITY CONTROL

Though the origin of quality of goods and services dates back to time immemorial the concept of quality control goes back to the middle ages. Feigenbaum has divided the chronological evolution of quality control into five phases, namely, operator quality control, foreman quality control, inspection quality control, statistical quality control (SQC), and total quality control. SQC employs statistical methods to manage the quality of goods and services. In 1924, Walter A. Shewhart of the Bell Telephone Laboratories laid the foundation for statistical quality control. Since then, the area of SQC has been enriched by the work of numerous statisticians, quality philosophers, and researchers. The prominent contributors include H.F. Dodge, H.G. Romig, Edwards Deming, Joseph M. Juran, Kaoru Ishikawa, and Philip Crosby, just to name a few. No doubt, SQC is renowned in the quality literature. However, there is a paucity of evidence that there is a chronological account of SQC to date in the literature.

The origination of statistical quality control is vividly expounded in Juran's writing of his memoirs of the mid-1920s. Juran states: "as a young engineer at Western Electric's Hawthorne Works, I was drawn into a Bell Telephone Laboratories initiative to make use of the science of statistics for solving various problems facing Hawthorne's Inspection Branch. The end results of that initiative came to be known as statistical quality control or SQC." It is evident from the above statement that the concept of statistical quality control has incepted in the Bell Laboratories in the mid-1920s. As the Bell Telephone Company was rapidly expanding in the mid-1920s, it was faced with various quality problems resulting from its large production of telephone equipment. As a result, the Bell Telephone Company set up a team to resolve this problem by using the science of statistics. According to Juran, the end result of this initiative came to be known as SQC. It was Walter A. Shewhart who first applied statistical methods to the problem of quality control. Shewhart issued

a memorandum in the Bell Telephone Company on May 16, 1924 with a sketch, which resembles a modern control chart. However, the term statistical quality control was coined by Shewhart later in 1931 in his book *Economic Control of Quality of Manufactured Products*. Table 2.1 provides a summary of the milestones in the history of statistical quality control.

Table 2.1: Selected Historic Milestones in the Quality Movement

Year	Milestone
1924	Walter Shewhart developed the control chart.
1931	Walter A. Shewhart of Bell Laboratories introduced statistical quality control in his book Economic Control of Quality of Manufactured Products.
1940	W. Edwards Deming assisted the U.S, Bureau of the Census in applying statistical sampling techniques.
1941	W.Edwards Deming joined the U.S. War Department to teach quality-control techniques.
1950	W.Edwards Deming addressed Japanese scientists, engineers, and corporate executives on the subject of quality.
1951	Joseph M. Juran published the Quality Control Handbook.
1954	Joseph M.Juran addressed the Union of Japanese Scientists and Engineers (JUSE).
1968	Kaoru Ishikawa outlined the elements of Total Quality Control (TQC).,
1970	Philip Crosby publisher introduces the concept of zero defects.
1979	Philip Crosby publisher quality is free.
1980	Western industry began to import the concept of TQC under the name Total Quality Management (TQM)
1980s	American electric giant, Motorola, pioneered the concept of six sigma.
1982	W. Edwards Deming published Quality, Productivity, and Competitive Position.
1984	Philip Crosby published Quality Without Tears: The Art of Hassle-Free Management.
1986	W. Edwards Deming published Out of Crisis.
1987	U.A. Congress created the Malcolm Baldrige National Quality Award.
1988	Secretary of Defense Frank Carlucci directed the U.S. Department of Defense to adopt total quality.
1993	The total quality approach began to be widely taught in the U.S. colleges and universities.

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SQC engages the following three methodologies:

1. **Acceptance Sampling**

This method is also called "sampling inspection." When products are required to be inspected but it is not feasible to inspect 100% of the products, *samples* of the product may be taken for inspection and conclusions drawn using the results of inspecting the samples. This technique specifies how to draw samples from a population and what rules to use to determine the acceptability of the product being inspected.

2. **Statistical Process Control (SPC)**

Even in an apparently stable production process, products produced are subject to random variations, SPC aims at controlling the variability of process output using a device called the *control chart.* On a control chart, a certain characteristic of the product is plotted. Under normal conditions these plotted points are expected to vary in a "usual way" on the chart. When abnormal points or patterns appear on the chart, it is a statistical indication that the process parameters or production conditions might have changed undesirably. At this point an investigation is conducted to discover unusual or abnormal conditions (e.g. tool breakdown, use of wrong raw material, temperature controller failure, etc.). Subsequently, corrective actions are taken to remove the abnormality. In addition to the use of control charts SPC also monitors *process capability,* an indicator of the adequacy of the manufacturing process to meet customer requirements under routine operating conditions. In summary, SPC aims at maintaining a *stable, capable* and *predictable* process.

Note, however, that since SPC requires processes to display measurable variation, il is ineffective for quality levels approaching six-sigma though it is quite effective tor companies in the early stages of quality improvement efforts.

3. **Design of Experiments**

Trial and error can be used to run experiments in the design of products and design of processes, in order to find an optimal selling of the parameters so that products of good quality will be produced. However, performing experiments by trial and error unscientifically is frequently very inefficient in the search of an optimal solution. Application of the statistical methodology of "design of experiments" (DOE) can help us in performing such experiments *scientifically* and *systematically.* Additionally, such methods greatly reduce the total effort used in product or process development experiments, increasing at the same time the accuracy of the results. DOE forms an integral part of Taguchi methods techniques that produce high quality and robust product and process designs.

2.4 PLANNING FOR QUALITY

Quality planning involves identifying which quality standards are relevant to the project and determining how to satisfy them. It is one of the key facilitating processes during project planning and should be performed regularly and in parallel with the

other project planning processes. For example, the desired management quality may require cost or schedule adjustments, or the desired product quality may require a detailed risk analysis of an identified problem. Prior to development of the ISO 9000 series, the activities described here as *quality planning* were widely discussed as part of *quality assurance*. The quality planning techniques discussed here are those used most frequently on projects. There are many others that may be useful on certain projects or in some application areas. The project team should also be aware of one of the fundamental tenets of modern quality management—quality is planned in, not inspected in.

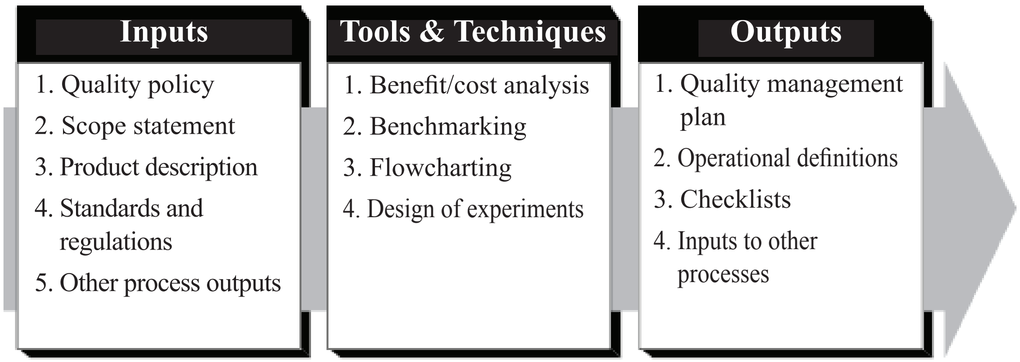


Fig. 2.1: Quality Planning

2.4.1 Inputs to Quality Planning

The following are the key inputs of quality planning:

1. ***Quality policy:*** Quality policy is "the overall intentions and direction of an organization with regard to quality, as formally expressed by top management". The quality policy of the performing organization can often be adopted "as is" for use by the project. However, if the performing organization lacks a formal quality policy, or if the project involves multiple performing organizations (as with a joint venture), the project management team will need to develop a quality policy for the project. Regardless of the origin of the quality policy, the project management team is responsible for ensuring that the project stakeholders are fully aware of it

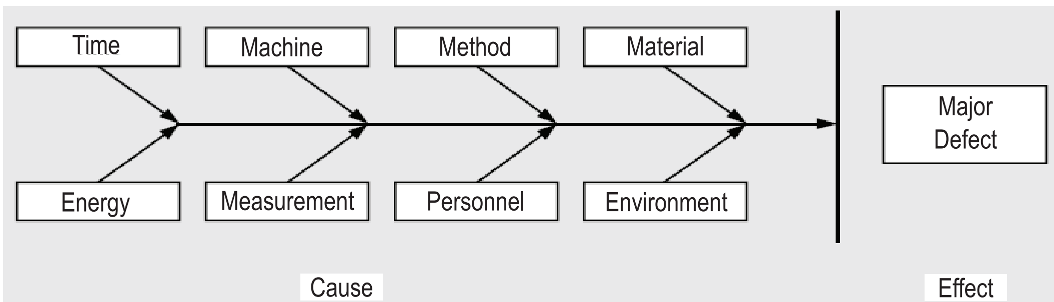


Fig. 2.2: Cause and Effect Diagram

2. ***Scope statements:*** The scope statement is a key input to quality planning since it documents major project deliverables as well as the project objectives which serve to define important stakeholder requirements.
3. ***Product descriptions:*** Although elements of the product description may be embodied in the scope statement, the product description will often contain details of technical issues and other concerns that may affect quality planning.
4. ***Standards and regulations:*** The project management team must consider any application-area-specific standards or regulations that may affect the project.
5. ***Other process outputs:*** In addition to the scope statement and product description, processes in other knowledge areas may produce outputs that should be considered as part of quality planning. For example, procurement planning may identify contractor quality requirements that should be reflected in the overall quality management plan.

2.4.2 Tools and Techniques for Quality Planning

The key tools and techniques used for quality planning includes the following:

1. ***Benefit/cost analysis:*** The quality planning process must consider benefit/cost trade-offs. The primary benefit of meeting quality requirements is less rework, which means higher productivity, lower costs, and increased stakeholder satisfaction. The primary cost of meeting quality requirements is the expense associated with project quality management activities. It is axiomatic of the quality management discipline that the benefits outweigh the costs.
2. ***Benchmarking:*** Benchmarking involves comparing actual or planned project practices to those of other projects in order to generate ideas for improvement and to provide a standard by which to measure performance. The other projects may be within the performing organization or outside of it, and may be within the same application area or in another.
3. ***Flowcharting:*** A flowchart is any diagram which shows how various elements of a system relate. Flowcharting techniques commonly used in quality management include:
   - *Cause-and-effect diagrams*, also called *Ishikawa diagrams* or *fishbone diagrams*, which illustrate how various causes and sub-causes relate to create potential problems or effects. Figure 2.2 is an example of a generic cause-and-effect diagram.

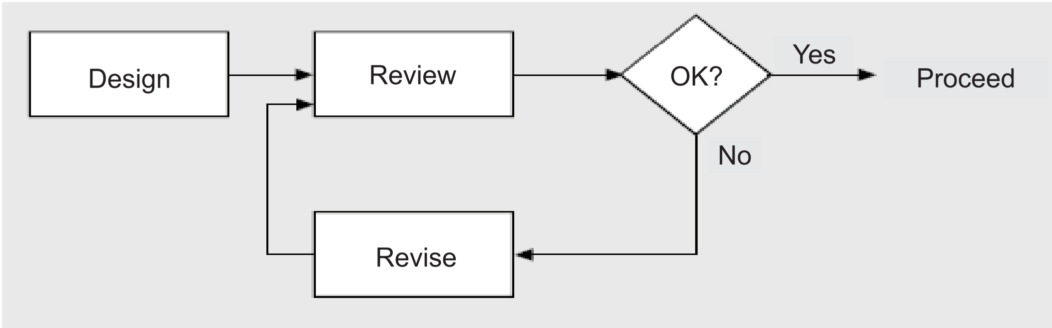


Fig. 2.3: Sample Process Flowchart

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- *System* or *process flowchart* which show how various elements of a system interrelate

Figure 2.3 is an example of a process flowchart for design reviews.

Flowcharting can help the project team anticipate what and where quality problems might occur and thus can help to develop approaches to dealing with them.

4. ***Design of experiments:*** Design of experiments is an analytical technique which helps identify which variables have the most influence on the overall outcome. The technique is applied most frequently to product of the project issues (e.g., automotive designers might wish to determine which combination of suspension and tyres will produce the most desirable ride characteristics at a reasonable cost). However, it can also be applied to project management issues such as cost and schedule trade-offs. For example, senior engineers will cost more than junior engineers, but can also be expected to complete the assigned work in less time. An appropriately designed "experiment" (in this case, computing project costs and durations for various combinations of senior and junior engineers) will often allow determination of an optimal solution from a relatively limited number of cases.

2.4.3 Outputs from Quality Planning

The key outputs for quality planning are as follows:

1. ***Quality management plan:*** The quality management plan should describe how the project management team will implement its quality policy. In ISO 9000 terminology, it should describe the *project quality system*: "the organizational structure, responsibilities, procedures, processes, and resources needed to implement quality management". The quality management plan provides input to the overall project plan and must address quality control, quality assurance, and quality improvement for the project. The quality management plan may be formal or informal, highly detailed, or broadly framed, based on the needs of the project.

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2. ***Operational definitions:*** An operational definition describes, in very specific terms, what something is, and how it is measured by the quality control process. For example, it is not enough to say that meeting the planned schedule dates is a measure of management quality; the project management team must also indicate whether every activity must start on time, or only finish on time; whether individual activities will be measured or only certain deliverables, and if so, which ones. Operational definitions are also called *metrics* in some application areas.
3. ***Checklists:*** A checklist is a structured tool, usually industry- or activity-specific, used to verify that a set of required steps has been performed. Checklists may be simple or complex. They are usually phrased as imperatives ("Do this!") or interrogatories ("Have you done this?"). Many organizations have standardized checklists available to ensure consistency in frequently performed activities. In some application areas, checklists are also available from professional associations or commercial service providers.
4. ***Inputs to other processes:*** The quality planning process may identify a need for further activity in another area.

Case Study: Dramatic Savings at Baldor Electric Company

Background

Headquartered in Fort Smith, Arkansas, Baldor Electric Company is a leading producer of industrial electric motors, power transmission products, drives and generators. In 2007, Baldor completed the acquisition of Reliance Electric Company, including Dodge mechanical and Reliance Electric motors, from Rockwell Automation. Baldor products are produced in 26 plants in the US, Canada, England, Mexico and China and are sold to distributors and OEMs in more than 70 countries worldwide. With an emphasis on quality, Baldor recorded $811 million in sales in 2006.

Challenge: Adopt Quality Improvement within the Corporate Culture

At Baldor, management believes in product quality just as much as production quantity. To ensure a high level of quality, Baldor decided to institute a policy dedicated to customer satisfaction. The policy would involve continuous quality and reliability improvements, with each employee playing a specific role.

With the new quality initiatives, Baldor's objectives were to:

- Improve gauging and measurement accuracy
- Decrease production cycle times
- Lower the cost of scrap
- Make faster and more accurate inspections

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To achieve these goals, Baldor needed to monitor quality data around the clock, and use data analysis to make process adjustments when needed.

The solution also needed to be user-friendly for the production and quality teams to quickly adopt as part of their job responsibilities. As part of the quality policy, Baldor instituted the methodology of Statistical Process Control (SPC) into the corporate culture with quality personnel, engineers and managers all using data to improve processes.

Solution: InfinityQS Real-Time SPC Software for Data Analysis and Decision-Making

Baldor implemented InfinityQS ProFicient™ SPC software in inner-ring machining, inner-ring grinding, outer-ring grinding, ring roller and face grinding cells, with plans to expand the application to induction heat treating, conventional heat treating and cast iron housing machining.

To meet the data analysis challenge, Baldor created an enterprise-wide mandate for quality improvement. Using ProFicient software, Baldor now creates SPC monitor charts and capability charts and makes them available to all employees with a shared responsibility for data analysis. A strategic group conducts regular meetings to share successful SPC techniques and make data driven quality decisions based on ProFicient's analysis tools.

On the shop-floor, Baldor evaluated gauging and made updates throughout its production facilities. Along with its user-friendly interface, ProFicient gives operators the framework for easier gauging methods with finer resolution gauges and better inspection tools and methods.

The improved inspection tools and methods have produced faster, more accurate inspections that generate a substantial costs savings. These savings are due to the elimination of secondary gauges and hand written charts and log books. InfinityQS software streamlined quality initiatives on the shop-floor and all operators are using the ProFicient database for check sheets.

Results: Decreased Cycle Times, Bottom Line Savings

As a result of their commitment to quality, Baldor was able to measure quality improvements throughout their manufacturing processes. The application of ProFicient's process-defined control limits led to a reduction in product variation. They were able to limit unnecessary machine adjustments by relying on actual data instead of personal preference when making adjustments.

Using InfinityQS in the inner-ring machining department, Dodge reduced the amount of leftover stock in the bores for grinding. This stock reduction decreased cycle times by an average of 15% per piece, yielding yearly savings of approximately 2511 production hours. The process now produces less variation in machined inner rings (±.0002” vs. ±.002”).

Baldor recorded significant cost savings as a result of the first phase of the InfinityQS implementation. They reported 66% annual dollar savings from reduced scrap for internal customers and 63% annual dollar savings from reduced scrap in InfinityQS work centers. The figures added up to a 13% reduction in overall scrap costs. Baldor's customers are on the winning end of the quality improvements as Baldor reports a 48% reduction in warranty claims. Baldor expects to see further savings as the InfinityQS implementation rolls out.

About InfinityQS International

InfinityQS is the leading provider of SPC software and services to a broad array of companies, from multinational giants to smaller, more specialized manufacturers. InfinityQS solutions empower manufacturers to monitor, control and improve the quality of their manufacturing operations across a site, an enterprise or an entire supply chain, continuing to provide significant returns on their initial investment. The company's goal is always to improve clients' internal quality standards and ensure their continued success in the global marketplace.

Source: *http://www.infinityqs.com/case-studies/baldor*

2.5 QUALITY PROCESS

Quality management includes the processes required to ensure that the project will satisfy the needs for which it was undertaken. It includes "all activities of the overall management function that determine the quality policy, objectives, and responsibilities and implements them by means such as quality planning, quality control, quality assurance, and quality improvement, within the quality system".

The following are the key elements of quality management process:

- **Quality Planning**: Identifying which quality standards is relevant to the project and determining how to satisfy them.
- **Quality Assurance**: Evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards.
- **Quality Control**: Monitoring specific project results to determine if they comply with relevant quality standards and identifying ways to eliminate causes of unsatisfactory performance.

These processes interact with each other and with the processes in the other knowledge areas as well. Each process may involve effort from one or more individuals or groups of individuals based on the needs of the project. Each process generally occurs at least once in every project phase. Although the processes are presented here as discrete elements with well-defined interfaces, in practice they may overlap and interact in ways not detailed here. Process interactions are discussed in detail in Chapter 3, Project Management Processes. The basic approach to quality

management described in this section is intended to be compatible with that of the International Organization for Standardization (ISO) as detailed in the ISO 9000 and 10000 series of standards and guidelines. This generalized approach should also be compatible with (a) proprietary approaches to quality management such as those recommended by Deming, Juran, Crosby, and others, and (b) non-proprietary approaches such as Total Quality Management (TQM), continuous improvement, and others. Project quality management must address both the management of the project and the product of the project. Failure to meet quality requirements in either dimension can have serious negative consequences for any or all of the project stakeholders.

For example:

- Meeting customer requirements by overworking the project team may produce negative consequences in the form of increased employee turnover.
- Meeting project schedule objectives by rushing planned quality inspections may produce negative consequences when errors go undetected.

Quality is "the totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs". The project management team must be careful not to confuse *quality* with *grade*. Grade is "a category or rank given to entities having the same functional use but different requirements for quality". Low quality is always a problem; low grade may not be. For example, a software product may be of high quality (no obvious bugs, readable manual) and low grade (a limited number of features), or of low quality (many bugs, poorly organized user documentation) and high grade (numerous features). Determining and delivering the required levels of both quality and grade are the responsibilities of the project manager and the project management team. The project management team should also be aware that modern quality management complements modern project management. For example, both disciplines recognize the importance of:

- **Customer satisfaction:** Understanding, managing, and influencing needs so that customer expectations are met or exceeded. This requires a combination of *conformance to specifications* (the project must produce what it said it would produce) and *fitness for use* (the product or service produced must satisfy real needs).
- **Prevention over inspection:** The cost of avoiding mistakes is always much less than the cost of correcting them.
- **Management responsibility:** Success requires the *participation* of all members of the team, but it remains the *responsibility* of management to provide the resources needed to succeed.
- **Processes within phases:** The repeated plan-do-check-act cycle described by Deming and others is highly similar to the combination of phases and processes.

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In addition, quality improvement initiatives undertaken by the performing organization (e.g., TQM, Continuous Improvement, and others) can improve the quality of the project management as well as the quality of the project product. However, there is an important difference that the project management team must be acutely aware of—the temporary nature of the project means that investments in product quality improvement, especially defect prevention and appraisal, must often be borne by the performing organization since the project may not last long enough to reap the rewards.

2.6 STATISTICAL PROCESS CONTROL (SPC) AND ACCEPTANCE SAMPLING

Quality of product and services determines success or failure of the organization. Consumers expect the company to maintain high-level of quality and consider it an important aspect of satisfaction. Quality management, therefore, becomes very important as far as any organization is concerned. Quality management can be accomplished through various quality control techniques. Quality assurance and quality control are objective-oriented and can be achieved through statistical quality control.

Statistical quality control requires usage of acceptance sampling and process control techniques. Statistical quality control extensively uses chart to measure the acceptance level of the product samples. Objective is to ensure that products fall within pre-decided upper control and lower control limits. Any sample falling outside the limits is inspected further for corrective action.

2.6.1 Statistical Process Control

Commonly used in the manufacturing process, statistical process control (SPC) makes use of statistical facts gleaned through statistical analysis to both monitor and control virtually any process where output can be measured. SPC makes use of a variety of tools inherent to the method to include experimentation, control charts and continuous improvement processes. The key difference between SPC and other process control methods is a focus on quantitative analysis, rather than opinion, when analyzing variations in a process. Applied to a wide range of processes aside from manufacturing, statistical process control focuses on identifying sources of variation and determining the extent of that variation. Based on such information, managers can make decisions regarding whether the variation is acceptable, if it signifies a problem or a positive causation that needs replicating.

Beginning with the premise that any output that is measurable will have variation from either common, natural causes or special, assignable causes, statistical process control seeks to determine if a variation is under statistical control. Using

Check Your Progress

1. What do you mean by statistical quality control?
2. Define continuous improvement.
3. State the meaning of quality planning.
4. What is scope statement?

control charts, analysts will look for variations in a process during the time period that chart specifies. Upon identifying those variations, the analyst will then use the chart to determine the origin of the variation and whether that variation is within a pre-determined, specified range. When identified variations fall within a predetermined, specified range, the process is defined as being under statistical control. If not, however, the process is then considered as being out of statistical control.

Variations that are found to be out of statistical control are said to originate from special, assignable causes. Such variations are usually determined by the actual process, and statistical software is often used to perform the required calculations, which are subsequently plotted on the control chart. Statistical process control aims to determine if a process in under statistical control, because if it is then the process can be predicted. Accurately predicting the outputs of a process provides analysts with important information, such as how long it will take to fulfill a specific type of production order. Thereafter, the concern with the SPC method is getting the process back under statistical control so that outputs can be predicted reliably.

Once a process is determined to be out of statistical control, assignable causes are searched for and determined whether they are positive or negative to the process. Negative causes are addressed after investigation to ascertain and eliminate the causation, and then the process is reanalyzed repeatedly with SPC until the problem is fixed. Positive causes usually follow the same process, but with the objective of implementing the causation at all times in the process.

The Seven Quality Improvement Tools

In SPC, numbers and information form the basis for decisions and actions. Therefore, a thorough data recording system manual or otherwise would be an essential enabler for SPC. In order to allow one to interpret fully and derive maximum use of quality-related data, over the past fifty years a set of simple statistical tools have evolved. These tools offer any organization an easy means to collect, present and analyze most of such data. In this section we briefly review these tools. An extended description of them may be found in the Quality Management Standard IS0 9004-4 (1994).The following are the seven quality improvement tools:

1. Flowchart

The flowchart lists the *order* of activities in a project or process and their *interdependency.* It expresses detailed process knowledge. To express this knowledge certain standard symbols are used. The oval symbol indicates the beginning or end of the process. The boxes indicate action items while diamonds indicate decision or check points. The flowchart can be used to identify the steps affecting quality and the potential control points. Another effective use of the flowchart would be to map the ideal process and the actual process and to identify their differences as the targets for improvements. Flowcharting is often the first step in Business Process Reengineering (BPR).

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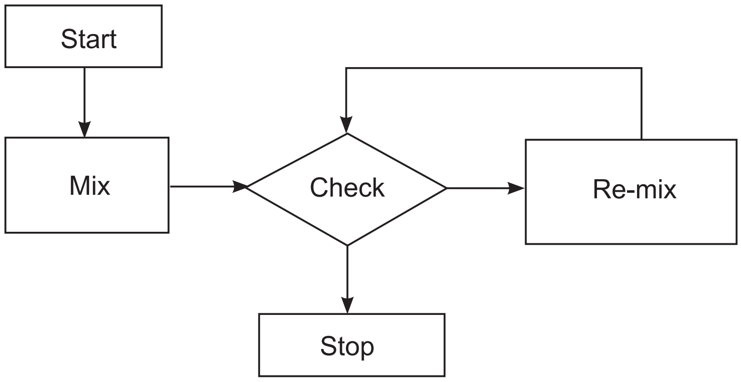


Fig. 2.4: Flowchart

2. Histogram

The histogram is a bar chart showing a distribution of variable quantities or characteristics. An example of a "live" histogram would be to line up by height a group of students enrolled in a course. Normally, one individual would be the tallest and one the shortest, with a cluster of individuals bunched around the average height.

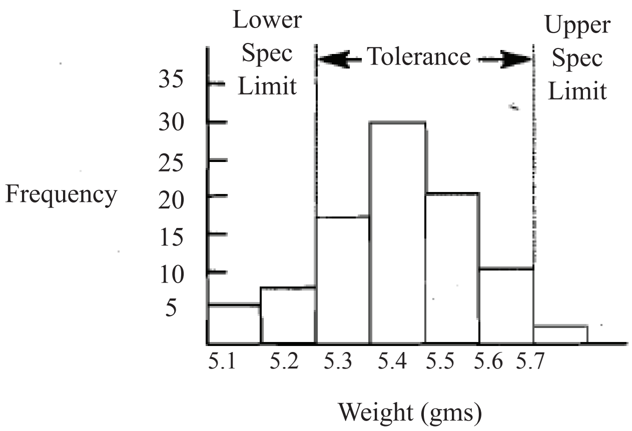


Fig. 2.5: Histogram

In manufacturing, the histogram can rapidly identify the nature of quality problems in a process by the shape of the distribution as well as the width of the distribution. It informally establishes process capability. It can also help compare two or more distributions.

3. Pareto Chart

A Pareto diagram is a histogram, ordered by frequency of occurrence that shows how many results were generated by type or category of identified cause. Rank ordering is used to guide corrective action—the project team should take action to fix the problems that are causing the greatest number of defects first. Pareto diagrams are conceptually related to Pareto's Law, which holds that a relatively small number of causes will typically produce a large majority of the problems or defects.

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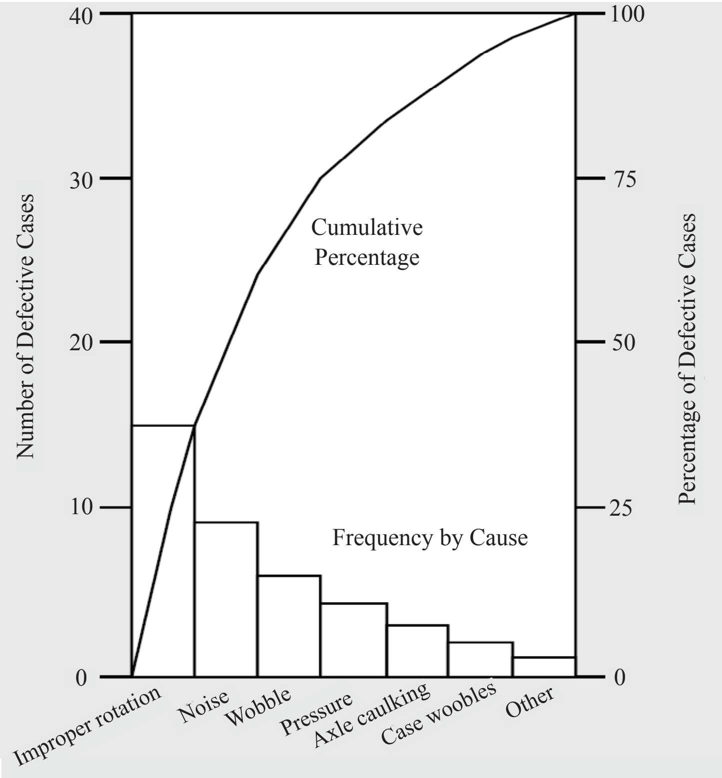


Fig. 2.6: Pareto Diagram

4. Cause and Effect Diagram

The cause and effect diagram is also called the fishbone chart because of its appearance and the Ishikawa diagram after the man who popularized its use in Japan. Its most frequent use is to list the causes of some particular quality problem or defect. The lines coming of the core horizontal line are the main causes while the lines coming off those are sub causes. The cause and effect diagram identifies problem areas where data should be collected and analyzed. It is used to develop reaction plans to help investigate out-of-control points found on control charts. It is also the first step for planning design of experiments (DOE) studies and for applying Taguchi methods to improve product and process designs.

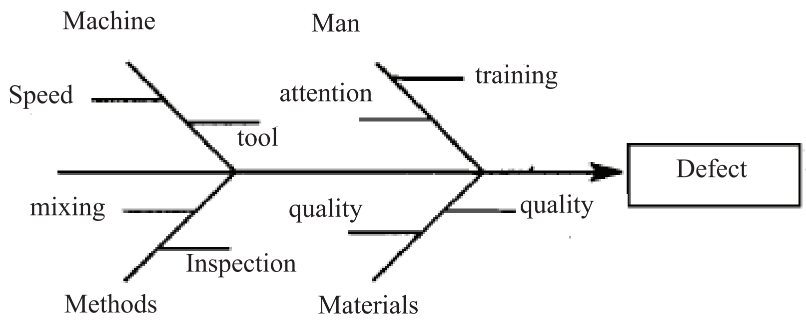


Fig. 2.7: Cause and Effect Diagram

5. Scatter Diagram

The scatter diagram shows any existing pattern in the relationship between two variables that are thought to be related. For example, is there a relationship between outside temperature and cases of the common cold? As temperatures drop, do cases of the common cold rise in number? The closer the scatter points hug a diagonal line, the more closely there is one-to-one relationship between the variables being studied. Thus, the scatter diagram may be used to develop informal models to predict the future based on past correlations.

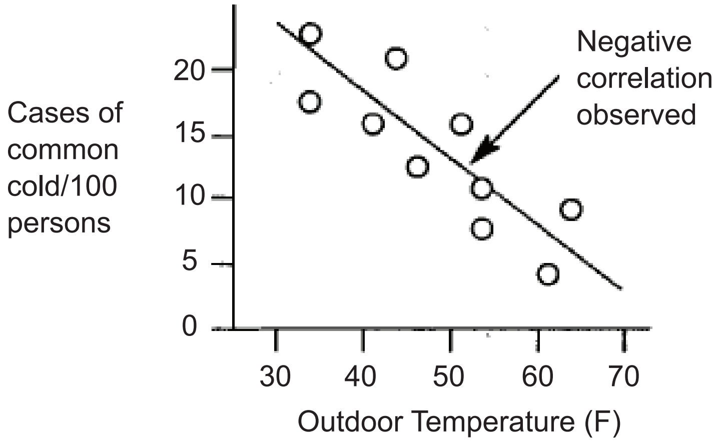


Fig. 2.8: Scatter Diagram

6. Run Chart

The run chart shows the history and pattern of variation. It is a plot of data points in time sequence, connected by a line. Its primary use is in determining trends over time. The analyst should indicate on the chart whether up is good or down is good. This tool is used at the beginning of the change process to see what the problems are. It is also used at the end (or check) part of the change process to see whether the change made has resulted in a permanent process improvement.

A Run Chart of Sample Average

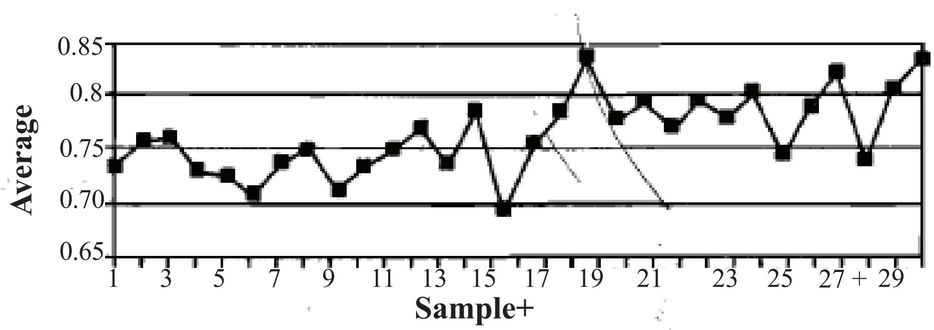


Fig. 2.9: Run Chart

7. Control Chart

Control charts are a graphic display of the results, over time, of a process. They are used to determine if the process is "in control" (e.g., are differences in the results created by random variations or are unusual events occurring whose causes must be identified and corrected?). When a process is in control, the process should not be adjusted. The process may be *changed* in order to provide improvements but it should not be adjusted when it is in control. Control charts may be used to monitor any type of output variable. Although used most frequently to track repetitive activities such as manufactured lots, control charts can also be used to monitor cost and schedule variances, volume and frequency of scope changes, errors in project documents, or other management results to help determine if the "project management process" is in control.

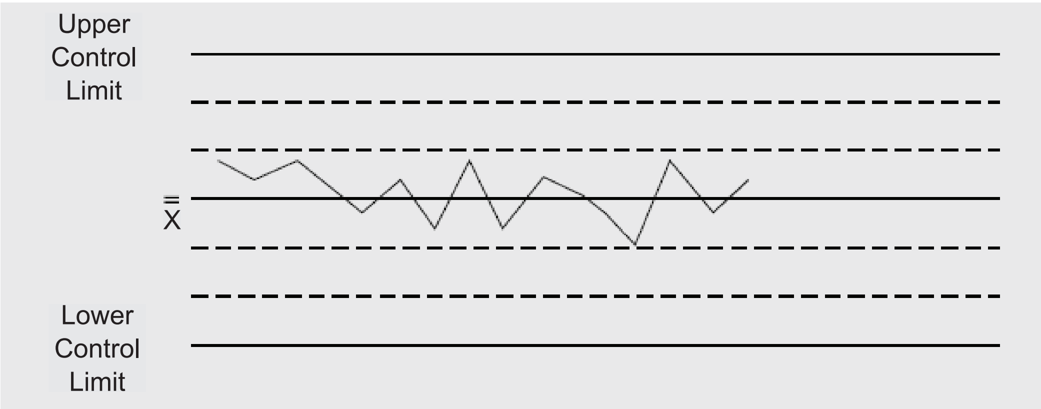


Fig. 2.10: Control Chart of Project Schedule Performance

2.6.2 Acceptance Sampling

Acceptance sampling is done on sample's post production to check for quality parameters as decided by the organization covering both attributes as well as variables. If the sample does not meet the required parameters of quality than that given lot is rejected, and further analysis is done to identify the source and rectify the defects. Acceptance sampling is done on the basis of inspection, which includes physical verification of color, size, shape, etc.

- The major objectives of inspection are:
- To detect and prevent defects in products and process.
- To identify defected parts or product and prevent it from further consumption or usage.
- To highlight the product or process defect to appropriate authorities for necessary and corrective actions.

Scope of inspection covers input materials, finished material, plant, machinery etc. To sustain quality of product and services it is important to have in place robust quality control techniques.

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A sampling plan is a method for guiding the acceptance sampling process. It specifies the procedure for drawing samples to inspect from a batch of products and then the rule for deciding whether to accept or reject the whole batch based on the results of this inspection. The sample is a small number of items taken from the batch rather than the whole batch. The action of rejecting the batch means not accepting it for consumption and this may include downgrading the batch or selling it at a lower price returning it to its supplier or vendor.

Quality Indices for Acceptance Sampling Plan

Many of the published plans can be categorized in terms of one of several quality indices:

- **Acceptable quality level (AQL):** This is usually defined as the worst quality level that is still considered satisfactory. The units of quality level can be selected to meet the particular needs of a product. Thus, MIL-STD defines AQL as "the maximum percent defective (or the maximum number of defects per hundred units) that, for purposes of sampling inspection, can be considered satisfactory as a process average." If a unit of product can have a number of different defects of varying seriousness, then demerits can be assigned to each type of defect and product quality measured in terms of demerits. As an AQL is an acceptance level, the probability of acceptance for an AQL lot should be high.
- **Rejection quality level (RQL):** This is a definition of unsatisfactory quality. Different titles are sometimes used to denote an RQL; for example, in the Dodge- Roming plans, the terms "lot tolerance defective (LTPD" is used. As an RQL is an unacceptable level, the probability of acceptance for an RQL lot should be low. In some tables, this probability is known as the consumer's risk, is designated as P and has been standardized at 0.1. The consumer's risk is not the probability that the consumer will actually receive product at the RQL. The consumer will in fact not receive 1 lot in 10 at RQL fraction defective. What the consumer actually gets depends on actual quality in the lots before inspection, and on the probability of acceptance.

Types of Sampling Plan

Sampling plans are of two types:

1. **Attributes plans:** A random sample is taken from the lot and each unit classified as acceptable or defective. The number defective is then compared with the allowable number stated in the plan, and a decision is made to accept or reject the lot.
2. **Variables plans:** A sample is taken and a measurement of a specified quality characteristic is made on each unit. These measurements are then summarized into a simple statistic (e.g., sample average) and the observed value compared with an allowable value defined in the plan. A decision is the made to accept or reject the lot.

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A comparison of attributes and variables sampling is given in Table 2.2. The key advantage of variables sampling plan is the additional information provided in each sample, which in turn results in smaller sample sizes as compared with an attributes plan having the same risks. However, if a product has several important quality characteristics, each must be evaluated against a separate variables acceptance criterion (e.g., obtain numerical values and calculate the average and standard deviation for each characteristic). In a corresponding attributes plan, the sample size required may be higher but the several characteristics could be treated as a group and evaluated against one set of acceptance criteria.

Table 2.2: Comparison of attributes and variables sampling plans

	Attributes	**Variables**
Type of inspection required for each item	Each item classified as defective or acceptable: go/no go type of gages may be used	Measurement must be taken on each item: higher skill level of inspection required
Assumption of underlying distribution	None	Some distribution must be assumed (usually normal)
Number of characteristics that can be reviewed in one sample	Any number	A separate sampling plan is required for each characteristic to be reviewed
Type of information provided for use in correcting process	Number of defectives (if go/no go gages are used)	Valuable information on the process average and variation is available to indicate type of process correction required.

Caselet: SPC, the Big Picture

by Douglas C. Fair

A few weeks ago, I found myself and my family on a beach making a sand castle. It was the last day of our vacation and shortly after we began working in the warm South Carolina sand, an official approached us and asked if we would like to be contestants in the weekly sand sculpture contest. Why not?

At first, we were just playing in the sand with no purpose. But since judges and bystanders were watching the progression of our work, we got serious. Soon we began incorporating architectural details that our red-plastic-bucket-toting competitors hadn't contemplated. We got serious solely because others were evaluating our progress. With knees in sand, our actions were driven by the adage, "What gets evaluated gets improved."

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The same can be said about an SPC system. Yes, it's important for operators to gather data. Yes, it's important that control chart alarms are acted upon by process experts. And yes, it's important for an operator to assess data from their shopfloor viewpoint. All of these actions support localized control of individual processes. And, of course, these are all actions necessary to sustain manufacturing consistency and control.

However, if no one actively oversees the big picture, the likelihood of reducing overall costs and improving macro quality will be minimal. The words "overall" and "macro" are meant to induce you into thinking much bigger than enhancement of a single processing line or machine. For some, "overall" might mean department-wide. For others, it might equate to improving quality for an entire plant. Yet others might interpret "macro" in a global sense-throughout all company-owned plants, and across a multitude of suppliers. So whether you are thinking department-wide or you are struck by the possibilities of improving quality across your entire supply chain, we must begin seriously viewing SPC systems in terms of the big picture.

That big picture should be carefully scrutinized by top management. Unless management is involved and overseeing an SPC system and its results, chances are that financial and quality results will be less than stellar. Again, what gets evaluated gets improved. If no one looks at the big picture, then bottomline business results that an SPC system provides cannot be fully exploited.

I know of several different companies that carefully focused on the goal of large-scale improvement and cost reduction via SPC. Each of these companies was extraordinarily successful and the turnaround for each was stunning. These amazing and successful SPC deployments I witnessed were very similar in execution, and performed in different industries. Although the companies and their businesses were different, their focus was similar. The way they deployed SPC and how management dealt with the system was very similar.

In the beginning these companies adhered to the basics, with which most companies are familiar. They trained operators, provided improvement resources for the shopfloor and helped users understand how to interact with the SPC technology. Each successful company also did two amazing things that I have rarely seen:

1. Each day top-level management meetings were held to evaluate statistical information from the previous 24 hours
2. Each month top-level management meetings were held to evaluate statistical information for the previous 30 days

Management leadership was intimately involved in the interpretation of data and results. Each meeting was performed in the early morning and was presided over by the highest ranking manager on site. That a plant or director-level manager was the meeting organizer helped emphasize the meeting's importance and sent

a clear and compelling message to the rest of the organization-quality data and their related statistics are exceedingly important.

Meetings were typically less than an hour in length. Based on hard statistics, information gleaned from the data helped steer specialists toward daily and monthly improvement activities. This allowed separate organizational disciplines to focus on the specific tasks that would best support their goals and those of overall plant operations.

In essence, each daily meeting provided strategic focus for short-term actions necessary to reduce costs and improve quality. Monthly meetings focused more on long-term actions needed to support operational goals. Based upon predictable process data and process capabilities, capital needs decisions could be deliberated using statistical data and defects information rather than hearsay and rhetoric. Although simple in execution, these meetings proved to be powerful organizational reminders of how important quality truly is.

The big picture was focused on by providing information such as:

1. Unusual events (statistical alarms, indications of out-of-specification material) for an entire plant. Events were sorted and categorized to allow management to define strategic actions that could be specified by:
   (a) Production line
   (b) Product family
   (c) Shift
   (d) Lot numbers
   (e) Batches, etc.
2. Process capability, defects and performance comparisons between
   (a) Different production lines
   (b) Different product codes
   (c) Different plants
   (d) Different shifts, batches, etc.
3. Processes that are best for manufacturing certain products (or families of products)

This shortlist in short provided information for better managing the businesses, including:

4. Pinpointing where quality resources should be placed
5. Identifying the most likely opportunities for cost containment
6. Determining which processes were in need of maintenance and repair versus those that required an infusion of capital for corrective action
7. Picking out product families that were causing the most defects and alarms
8. Specifying shifts requiring additional engineering/process control support
9. Identifying machine settings best for minimizing customer complaints and maximizing line speeds

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10. Allowing scheduling to identify the production lines best suited for running specific products

These companies were successful because their top management was driving the system to see how best to improve financial and operational performance. Their deeply involved management staff treats SPC data as it should be treated-as an opportunity for making the overall business better. And isn't that the whole idea? I mean, hey, I love statistical methods like the next guy, but I also know that statistical methods aren't used for altruistic purposes. Use of SPC should be considered an operations and business decision for achieving ends that managers understand-minimize costs, maximize productivity, and drive profitability to the bottomline.

Summary

The issues we focus upon most are those that have the highest probability for success. It's no different for an SPC system. I have seen companies shocked by the wealth of information that an SPC system can provide. From ways to minimize overall defects to settings necessary to ensure the fastest run rates and the most efficient plant, big-picture statistics can transform a company's performance and competitive position while helping it to minimize overall costs. Standing on that beach in Hilton Head, I understood this on a small scale. Those overseeing our plastic-shovel work motivated my family to focus on the big picture. I'm proud to say we won that sand sculpture contest. The grand prize? A large pepperoni pizza. I smiled and thought to myself that by focusing our efforts, we lowered our costs. Even if it was only lunch.

Source: *http://www.infinityqs.com/articles/spc-big-picture*

2.7 QUALITY ASSURANCE: VENDOR QUALITY

Quality assurance (QA) is a process-centered approach to ensuring that a company or organization is providing the best possible products or services. It is related to quality control, which focuses on the end result, such as testing a sample of items from a batch after production. Although these terms are sometimes used interchangeably, quality assurance focuses on enhancing and improving the process that is used to create the end result, rather than focusing on the result itself. Among the parts of the process that are considered in QA are planning, design, development, production and service.

The Shewhart Cycle

There are many QA tools that organizations can use and that will help guide them through the steps that are needed to ensure that their processes are as efficient and productive as possible. One of the most popular tools is called the Shewhart

cycle, which was developed by Dr. W. Edwards Deming, a 20th-century American management consultant who named the tool after his associate, Walter A. Shewhart. This cycle for quality assurance consists of four steps: Plan, Do, Check and Act (PDCA). At the end of Shewhart cycle, which also is called the Deming cycle or PDCA cycle, the steps are repeated to ensure that the process is being evaluated and improved on a constant basis.

Four Steps

During the first step of the PDCA cycle, plan, the organization should establish its objectives and determine the processes or changes in the processes that are required to deliver the desired results. The second step, do, is when the processes or changes are developed and tested. In the third step, check, the processes or changes are monitored and evaluated to determine whether the results are meeting the predetermined objectives. The final step, act, is when actions that are necessary to achieve the desired improvements are fully implemented into the process. The cycle can then be repeated, beginning with new objectives being planned.

Excellence in Every Component

The Shewhart cycle can be an effective method for achieving quality assurance because it analyzes the existing conditions and methods that are used to provide the product or service to customers. The goal is to ensure that excellence is inherent in every component of the process. Quality assurance also helps determine whether the steps that are used to provide the product or service are appropriate for the time and conditions. In addition, if the cycle is repeated throughout the lifetime of the product or service, it helps improve the company's efficiency by ensuring that the process is always being refined and improved.

Attention to Detail

Quality assurance demands a degree of detail in order to be fully implemented at every step. Planning, for example, could include determining specific levels of quality or measurable results that the organization wants to achieve. Checking could involve testing and other objective measurements to determine whether the goals were met, rather than mere subjective evaluation of quality. Acting could mean a total revision in the manufacturing process to correct a technical or cosmetic flaw or very small changes to improve efficiency or accuracy.

Competition to provide specialized products and services often results in breakthroughs as well as long-term growth and change. Quality assurance verifies that any customer offering, regardless whether it is new or evolved is produced and offered with the best possible materials, in the most comprehensive way and with the highest standards. The goal to exceed customer expectations in a measurable and accountable process is provided by quality assurance.

2.8 ZERO DEFECT MANUFACTURING

The zero defects approach focuses managerial attention upon ensuring that processes are within acceptable deviations from targets, for example, plus or minus 0.001 millimeter thickness. Any departure from the nominal value means a loss. A bar of chocolate which is slightly below the target value started on the wrapper results in a loss to the purchaser. The manufacturer too may suffer a loss. For instance, the cumulative effect of so many underweight bars may mean boxes cannot be packed as tightly as they should be, resulting in damage in transit. Loss is also incurred if the bars are slightly above the mid-value. For instance, a surplus of three grams multiplied by 1, 00,000 bars in 3 kilos of raw material, plus additional handling costs. The customer too may suffer a loss. Taguchi, for instance, quotes the case of the person on a diet eating a product which is three grams heavier than anticipated.

Possible Pitfalls of Pushing Zero Defects

Quality guru W. Edwards Deming believed that slogans and programs such as zero defects are usually counterproductive. D.C. Montgomery, author of the book *Introduction to Statistical Quality Control*, agrees, commenting that these programs typically do not drive the "use of proper statistical and engineering tools into the right places of the organization," and they "devote far too little attention to variability reduction." In other words, the use of slogans such as zero defects to spur quality may lead to a de-emphasis of the tried-and-true tools and culture associated with successful continuous improvement.

But can a mere slogan actually discourage the successful implementation of proven six sigma continuous improvement methodologies? This can best be answered by considering the expectations, the conflicts and the different levels of understanding surrounding the term zero defects.

Literally zero defects correspond to a defect level of infinity sigma, which most practitioners will admit is not possible. And yet an enthusiastically institutionalized zero defects program may unfortunately promote the belief and expectation that true zero can and should be achieved. This is evidenced by several phrases that quality professionals may have heard spoken – or at least heavily implied – by business strategists:

- "All defects are the same, since all defects are bad"
- "There is no such thing as a benign defect."
- "If we can get rid of the defects, then we can get rid of the testing."

These expectations are worth examination.

Statements That Do Not Align with Facts

In fact, all defects are not equal. Defects, depending on their size and type, have different probabilities of impacting the finished product. And these probabilities

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depend on the technology. In fact, the impact probability of a particular defect may vary within the technology – that is, at the stage or layer in which it occurs. When it comes to the practical definition of a defect, "bad" is a relative term. Many defects are simply neutral. They are never good, but – again, depending on the technology – they may cause no harm either. If all defects are considered bad, then prioritization is difficult.

It is the role of statistically minded scientists and engineers to classify defects and their potential impact, based on data and engineering judgment. This allows them to systematically reduce defect levels in a prioritized fashion, starting with the worst and progressing toward the more benign. Without this kind of problem-solving prioritization, progress may be slow and confused – perhaps even at a standstill. The ability to prioritize is absolutely necessary in the continuous improvement process.

The statement that if fewer defects are produced, then less inspection will be required is incorrect. Actually, the opposite is true. A higher level and sophistication of testing is required to detect a smaller level of defects. The plot in Figure 2.11 derived from a cumulative binomial distribution (pass/fail inspection) shows how the sample size increases exponentially as the prevalence of a defective unit decreases. The particular curve in Figure 2.11 corresponds to a probability of detection of 95 percent. In other words, if a defect is present at the indicated level (x-axis), there is a 95 percent probability that at least one failed unit will be detected using the sample size indicated on the y-axis.

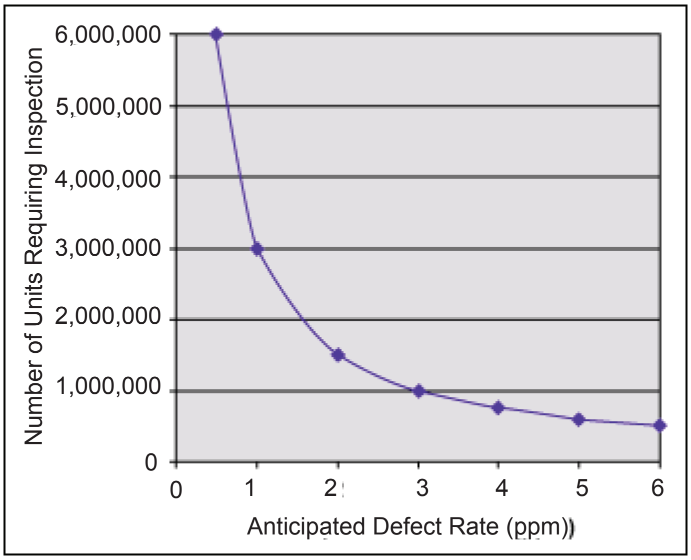


Fig. 2.11: Sample Size versus Probability of Failure

For example if a shoebox full of needles is mixed into a haystack, only a portion of the haystack will have to be moved before the presence of needles is detected. If there is only one needle in the haystack, every straw may have to be moved before it is found, assuming it is not missed entirely.

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This is really the misunderstanding that drives the inappropriate application of a zero defects policy to multiple points along the supply chain (Figure 2.12). It may be thought that producing zero or near-zero defects at each point will lead to reduced or eliminated inspection/testing prior to shipment to the end-customer. But for zero defects to approach reality, the inspection/testing must remain the same or increase at the final inspection point. If zero is truly the goal, then 100 percent sampling at the "escape" point is required, regardless of defect levels. This implies, then, that any zero defect inspections prior to the escape point may be non-value-added.

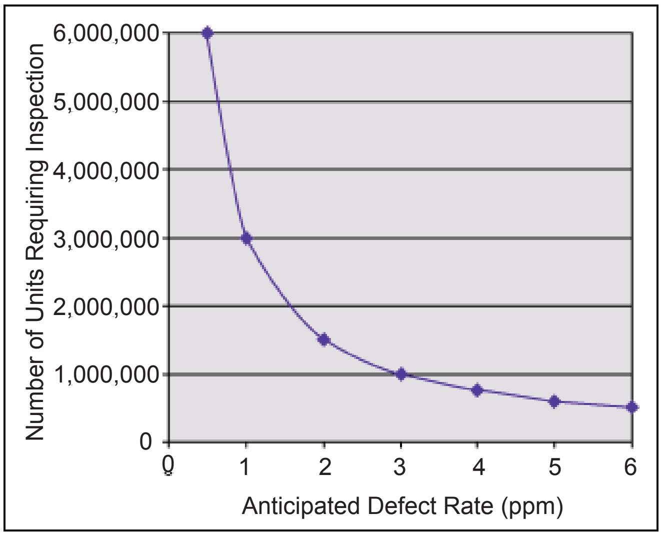


Fig. 2.12: A High-level Flow of Serial Product Manufacture, Across Supplier and Customer Boundaries

Ideally suppliers need to produce the highest quality output possible, in order to maximize yield and minimize costs which ultimately benefits both the supplier and the customer. But a zero defects policy does not provide this motivation to suppliers. When the goal of zero defects is applied to multiple interim points along the supply chain, the undesired effects of increased costs and lower yields are encouraged. The increased costs come from increased tests, inspections and cycle time. The lower yields are likely because of a higher rate of "false fails" (type 1 errors) as the suppliers apply increasingly stringent criteria in an attempt to eliminate potential failures at the customer's incoming test/inspection. In other words, in an effort to eliminate even the smallest possibility of customer incoming test failures, good product may be scrapped to overly stringent criteria.

Negative Impact on Workforce and Supply Chain

A focus on zero defects may be stifling to a discussion of continuous improvement, and may lead to frustration and non-productivity. To the general workforce, it may be a demoralizing concept. While everyone understands that continuous defect reduction is critical and necessary, most people understand, intuitively at least, that true zero is unachievable. Always striving for an unachievable goal may eventually de-motivate

even the most optimistic of employees, particularly if they are frequently told that their defect level is unacceptable – because it is not zero.

For a company's suppliers, continuing to add tests and inspections in an effort to comply with zero defects (perhaps at their customer's demand) may eventually drive them out of business. Thus, while continuous improvement is applicable to everyone, zero defects can or should only be applied to the final supplier, rather than at interim points along the supply chain. Attempting to do the latter may eventually put one or more of the suppliers in jeopardy. If a supplier critical to the company were to fail, the company's supply chain might collapse, which might eventually put the company out of business too

Finally, it should be realized that the inspections and tests themselves (however careful and precise they are) have a finite probability of actually causing a defect. This concept is somewhat akin to the uncertainty principle: "We may significantly modify what we are trying to measure simply by making the measurement."

Since the slogan zero defects implies immediate compliance to a defect-free standard, it may not leave time for the continuous improvement process to occur. In fact, it may even slow down the continuous improvement process because of the massive resources that inspected-in quality entails.

Zero defects is a message that can carry with it confusion and misinterpretation, mixed with technical impracticality. It may be appropriate that the idea of zero defects be replaced with a policy of zero escapes, since the latter has limited interpretation. As a company is doing all it can to improve the product and business using continuous improvement techniques, it also needs to consider what it can do to prevent a random, low-level defect from reaching the final customer. In this regard, zero escapes of defects may be a complimentary activity to continuous improvement.

A logical strategy is to employ continuous improvement methodologies everywhere in the business and manufacturing process to improve quality and yield, and reduce cycle time and costs. Then, at the point of shipping the final product to the final customer, employ a zero escapes methodology to help ensure that a randomly defective unit does not reach its final application. The tools and techniques developed and employed at this final gate should be arrived at through a team effort of the various suppliers and interim customers. Expecting individual suppliers in the supply chain to produce zero defects, in an effort to eliminate or minimize the final gate, is likely to be an impractical strategy.

Case Study: The Magic of Ford

In 1903, in a small wagon shop in Dearborn Michigan, a man by the name of Henry Ford started what is today the Ford Motor Company. It started it in 1896 when Henry Ford built his first car. It was only experimental at the time, but less than ten years later in 1908 he introduced a more updated version to the public. This became known as the Ford Model t. Once people realised what a

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wonderful novelty this was and how it would greatly facilitate their lives, there was a huge demand for them. In order for the company to be able to satisfy this heavy demand, Ford introduced the world's first assembly line for cars. It revolutionised the industry. By 1923 more than half of America's vehicles were made by Ford. Today, the Ford Motor company is the number two company in its industry as well as the number two industrial corporation in the world. When the average person thinks of the Ford Company, they think of just Ford. This thinking, however, is incorrect. Ford is divided into four major components, automotive, Ford credit, Visteon and Hertz. Ford also produces vehicles under the names of Aston Martin, Ford, Jaguar, Lincoln and the Mercury and Volvo brands.

Recently, Ford profits have increased significantly, for the nine months ending 30/09/06; total revenues increased 9% to 127.48 billion dollars. Net income from continuing operations decreased 10% to $4.32 bllion dollars. Results reflect increased vehicle sales offset by higher warranty and costs related to the Firestone recall. Last year's total sales went up 13% to become 163 billion dollars and profit also rose 10% to become $7.2 billion dollars. As far as Ford Motor Company can remember, this is more than any other car company ever. Ford's main automotive competitors are General Motors, DaimlerChrysler, Toyota, Honda, Nissan and Volkswagen.

One of the ways that Ford has established its spot as the number two company in the automotive market is its focus on customer satisfaction. Ford Motor Company admits that its greatest asset is the trust and confidence earned from its consumers. When people see a Ford trademark, Ford wants them to associate that with a trust mask of certitude, quality, reliability of performance and value. Ford strives to connect with their customers as well as reach them. They try to use relationship marketing, because it is cheaper to keep an old customer rather than to attract new ones. William Clay Ford, Chairman of the the Board for Ford Motor Company says that satisfying customers goes beyond great products and services. People want to do business with companies who care

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about them and their environment. He realises that the best cars are socially and environmentally responsible. Chief Executive Officer, Jacques A. Nasser states, “we will be a leader in corporate citizenship if we are a well trusted company that people believe contributes positively to a society and uses its resources to create a more sustainable world.” Jim Vannier, Manager of Ford’s advertising and marketing programs admits “if you listen to your customer, if you provide the right product at the right time, you’ll get the numbers”. The above quotes make it quite obvious that the top executives of the company all concur that customer satisfaction is of the utmost importance in succeeding. If they keep the customer happy, the customer will tell the others they are satisfied, and more and more people will be wiling to consume their product.

Here and Now

The twentieth century was profoundly affected by the innovations of Henry Ford. The inventions of the automobile gave opportunities to multitudes of people. These opportunities were not just in transportation, but in occupation as well. Today, no matter where a Ford is produced, the consumer knows that they are receiving a high quality product. The reason for this is that the majority of Ford vehicles parts are designed by Ford engineers, manufactured in Ford plants and assembled in Ford product lines. When you purchase a Ford product, you are truly purchasing Ford quality. Ford is the number two manufacturer of automobiles, second only to the General Motors Corporation.

This case highlights certain strategies of this corporation that propelled it to its current number two spot in the market. There are many aspects of marketing strategies that will be discussed in this case such as, product strategies, promotion strategies, pricing strategies as well as internet marketing and other forms of product distribution. Each one of these strategies plays a key role in the success of the number two motor company in the automotive industry. Many people tend not to realise just how important the marketing of a new product can be. It plays a huge role in the success or failure of the new product. For example, many people may remember many years ago when Ford came out with a new vehicle called Edsel. The Edsel became known as one of the Ford Motor Company’s Lemon. Although the thought of such an odd-looking car does not sound appealing, it is said that the look is not what caused its downfall. Surprising as it may sound, the demise of this vehicle was due to poor marketing strategies. Ford’s biggest mistake in marketing the Edsel was their failure to decide on their target market. They tried to market their product to everyone, and with such a large span of people this was next to impossible for becoming a success.

Objective of the Company

The mission of the Ford Motor Company is very basic. Ford sees their customers as one of the most important things; they know their customer satisfaction also

plays a gigantic role in their success. “[their] mission is to improve continually [their] products and services to meet [their] consumer’s needs, allowing [them] to prosper as a business and to provide a reasonable return for [their] stockholders, the owners of the business. Their mission shows their devotion to constantly improve and while improving, accommodate their customer’s needs. Ford’s five main principals include, 1) Quality: they put the quality of their products first and foremost. Without a quality product, people have no desire to waste their money or jeopardise their safety. 2) Customer Care: if you don’t take care of the customer, someone else will. 3) Constant Improvement: if the Ford Motor Company allowed themselves to remain stagnant in their environment, their competition would eventually have a huge advantage over them, because they would have newer and better product lines to offer. 4) Employee Involvement: Ford wants each and every employee to be involved in their company. The happier the employees, the better they work. It is all about feeling that they are a part of the Ford team. They also want their employee to think like a consumer, they can cater more to the needs of their actual consumers because they will know what the consumers want. 5) They consider dealers and suppliers to be their partners: without the dealers and suppliers Ford would not be able to manufacture the things they need alone and therefore would not be able to produce as many vehicles as there would be a demand for or even be able to distribute them all to people.

The Arena

Ford has many competitors. Since Ford is ranked the number two company, its main competitor is quite obviously the number one company, General Motors Corporation. General Motors, also an American Company holds 29.4% of the automotive market share while following close behind them the Ford Motor Corporation holds 25.1% of the top 5 best selling cars in 1999, Ford Taurus appears as number three and Ford Escort appears as number five in a recent survey. The automotive industry has fierce rivalry among its competitors. In the past years the following mergers have occurred- Daimler Benz acquired Chrysler and Ford bought Volvo in order to be able to properly compete with General Motors, this way Ford is not allowing General Motors to become too much larger than they already are. If General Motors develops a new feature or automobile, Ford must be right behind them with their most innovative invention, and vice-versa.

Ford has 25.1% of the market share presently. This is quite impressive considering that the number one automotive company, General Motors, also an American company has 29.4%. This means that the top two companies hold more than 50% of the market share. This is quite extraordinary. The total market value of the Ford Motor Company is approximately $56 billion dollars and their profits are well over $7 billion. In 2005 Ford sales raised up to $163 billion dollars. This was a thirteen-percent increase from the previous year.

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Check Your Progress

State Whether the Following Statements are True or False

5. The flowchart lists the order of activities in a project or process and their interdependency. It expresses detailed process knowledge.
6. The Pareto chart is a bar chart showing a distribution of variable quantities or characteristics.
7. The histogram diagram is also called the fishbone chart because of its appearance and the Ishikawa diagram after the man who popularized its use in Japan.
8. The scatter diagram shows any existing pattern in the relationship between two variables that are thought to be related.
9. Quality assurance (QA) is a process-centered approach to ensuring that a company or organization is providing the best possible products or services.

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The Catch

A car, if not properly assembled, maintained, and operated can become a deadly weapon. The United States government regulates many aspects of the auto motive industry. Among these regulations are seatbelts, airbags and shatter proof windshields. The government has also made inspection and maintenance programs more expanded, in order to include more areas and allow for more stringent tests. In 1990 the government amended the Clean Air Act. The main focus of the act was to cut down on all the urban smog, carbon monoxide and particular emissions from diesel engines and to help decrease acid rain and toxins that motor vehicles contribute to. The amended act demands that polluted cities must sell improved gasoline that helps to reduce ozone forming hydrocarbons and carbon monoxide. Once inside an automobile, the operator of the vehicle is responsible for obeying many regulations as well. It has become extremely important, for instance, to wear your seat belt. Primary enforcement seat belt laws allow police to stop and ticket a driver for not wearing a seat belt, just like any other traffic violation. Seventeen states and the District of Columbia have enacted these laws. The remaining 32 states have secondary laws that allow law enforcement to ticket a driver for not belting up only after the person has been stopped, or ticketed, for another violation, and one state does not have any seat belt law. Obviously, safety best laws work, and the public overwhelmingly supports them. Three out of four Americans supports safety belt laws, according to a recent public opinion survey. Stronger safety belt and child passenger safety laws, and stepped up enforcement of those laws, are the most effective steps we can take to save lives.

Corporate Responsibility Towards Society

Ford Motor Company sponsors many programs to better the community and their safety. For example in the Detroit area, Ford organised a weekend clinic in which the automotive safety office educated fifty-five people and their children on the proper use and installation of child safety seats. They demonstrated this in the consumer’s actual vehicles. Ford is also committed to environment cleanliness. They sponsor programs to educate our children on environmental cleanliness and responsibility. They also sponsor company-wide recycling, cleaner operating vehicles, recyclable components, cleaner manufacturing, and employee involvement in environmental activities. Ford do not do these things because they have to, they do it because it is the right thing to do. The Ford Motor Company not only is social active, but culturally as well. Ford provides financial support at many historically black colleges such as Tuskegee University in Albama, this is where the famous black inventor George Washington Carver performed many of his experiments. Ford Motor Company, as of 1999 has 23.2 percent of its employees as minorities. This is up 1% from 1998. Diversity makes the business world go round and no one knows this better than the Ford Motor Company.

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Innovation or Death

The Ford Motor Company values their product analysts. [Their analysts develop product cycle plans that help forecasters determine [their] approach to different markets. The people who start the product cycle are called the research, design packaging and financial analysts. The researchers find out what type of things that consumers would like their vehicles to be occupied with. The design packagers are the people who decide the most appealing way to package the final product. The financial analysts put the numbers together to figure out exactly how much money all of the above will cost. Next, designers and engineers along with testers actually create the vehicles. They create vehicles according to the specifications of the Research, Design Packaging and Financial Analysts. This way they are producing what the market wants. The research and advanced technology teams then decide which technologies should be used in the new products. Ford is constantly trying to improve their product development and expand their innovations. Currently, Ford is working on a new line of intelligent vehicles. These vehicles will enable the driver, through voice activation, to connect to the internet. The voice activation will also be implemented into the navigation system, heating and air-conditioning, cell phones, audio systems, and other electronic things inside the automobile. Ford is adapting to each change in order to be able to bring their customers the most innovative and convenient products possible. As soon as new technology becomes available, Ford Motor Company is among the first few to try to implement it into their vehicles.

Product Targeting

Ford Motor Company has different types of cars, which are each targeted towards many different markets of people. As the company learned the hard way with the Edsel, the importance of a target market is extremely high. Loss of a target marketing focus usually means loss in sales. Ford has a different car targeted towards different age groups, personalities, genders and economic standing and more. The Ford Mustang, for example, is targeted mainly at the middle aged. This is exhibited by its slogan of it is what it was and more. This implies that the target consumer would be old enough to remember what the Mustang was when it first came out in the 1960s.

Another example is Ford trucks. Their slogan is “Built Ford Tough”. The toughness implies a target towards rugged men. Because of the fact that the word “tough” is used, it seems that it would be very unlikely that the Ford motor company would be using that to attract women. When the word tough is thought of, women are generally not the first thing that comes to mind. The third and final example is the Ford Taurus. Its slogan is “Ford makes it smart to buy American.” The target market for a Ford Taurus is a family. The Taurus station wagon for instance is a great family car with tons of room, yet it handles like a sports car. The above three examples are only a small sampling of what Ford offers. Ford

Motor Company manufactures sedans, SUVs, trucks, luxury cars and more. If you are looking for it, the odds are that Ford will satisfy you.

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Product Mix

The Ford Motor Company has such a wide selection of vehicles in order to satisfy every different type of potential consumer. They offer small cars, sports car, midsize cars, luxury cars, vehicles, convertibles, wagons, minivans, vans, trucks, commercial trucks, and even environmentally efficient cars. Each of Ford's different types of vehicles have many different options that came along with them the 2001 Explorer for example, runs to roughly $25,715 dollars, without any extras. However, should the consumer decide that he or she would like to add perks, there would be many choices. For instance, in the convenience group of options, you can add anything from a cargo cover to speed control. In the XLS sports group anything from chrome steal wheels to wheel mouldings. There is even a trailer tow prep package, which includes a wiring harness and an H.D. Flasher for only $355 dollars extra. After that the consumer has the option to add even more options. They can customize the engine, transmission, drive, rear axle, wheel type, tyre type, seat equipment and much more. The company also offers the Explorer in 10 different colours for the exterior. With the plethora of the above options, how could anyone not find what they are looking for? Each one of the 24 cars manufactured under the Ford name has many options as the Explorer, if not more.

Services Offered

When you own a Ford vehicle, you can register for Owner's Services. This includes reminders of when your vehicle needs to be services, tips for vehicle safety, maintenance information, does it yourself pointers and online manuals. It also includes warranty guides, offers and discounts exclusive to people registered for the service, online shopping, private communications, and links to Ford Company Specialists. Ford, Lincoln, and mercury dealerships specialize in the servicing of their own vehicles. The dealership is a wonderful place to go to have your breaks served, shocks replaced and batteries as well. The company also offers Extended Service Plan (ESP). With the extended warranty plan and the factory unlimited warranty; you are able to choose a plan that suits your needs. The way the plan works is, you pay a small deductible anywhere from $0-$100. The Ford ESP cost protects the consumer from increasing prices in labour and increased prices in parts. Other services that are offered by Ford Motor Company area Customer Assistance Centres, Collision Assistance, Roadside Assistance, Technical Service Information and their website. The website includes links to safety tips and Frequently Asked Questions.

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Promotional Strategies

The current promotions that are offered by the Ford Motor Company are radiator service, brake service, and batteries. All of the above promotions are wonderful for the upcoming winter months. The radiator service includes, top of all fluids and a free 12pt all weather check of hoses, clamps, belts and more. This promotion and all of the above promotions appeal to people who are thinking ahead to cold winter months. This winter in New York has been predicted to be one of the worst we have seen in a while. A radiator is not actually something you would want to break down in the middle of a snow storm. The battery promotion is offering a Motorcraft tested, though series battery. They are also offering a Silver Series Battery for only $20 dollars more. Each promotion for a new battery comes with over an 83-month warranty. It is a good idea to replace your battery before a new winter season. When it is freezing outside, trying to find a good samaritan who is willing to give you a jump is a rarity. The brake promotion comes with the motorcraft brake service. This promotion includes replacement of brake pads or shoes, front or rear turn rotators and drums. This promotion will also check the brake's hydraulic system and repair, if necessary. This once again appeals to the person(s) who is preparing for the harsh winter to come. Being that, a bad winter generally means a lot of snow and ice. With weather conditions like that, who needs to worry about brake failure?

Pricing Strategies

One of Ford's pricing strategies is the fact that they try to help the consumer finance a Ford vehicle. Ford offers its consumer many plans to choose from in order to find the financing option that best fits their needs. The following are only a few of Ford's financing options. The first is the Red Carpet Lease: the consumer is offered flexibility for payment; there are advance payment plans and additional payment programs, depending on which one is best for you. The second financing plan is mobility financing: mobility financing offers flexible and convenient financing terms for their physically challenged consumers who need adaptive equipment in their vehicles. The finance rate is based on your credit and the terms of the transaction. Ford credit has earned a top ranking place in the world of automotive finance by providing loans and leases that are convenient and affordable. They also specialize in service such as commercial lending and municipal financing.

The municipal financing is so convenient that it can be calculated on the internet. All that needs to be done in order to do this is, select a vehicle, model, make, and product line. The online calculator will give the consumer an estimated lease and retail payment. Ford financing company provides a variety of products and services to both, the dealers and the consumers. Ford credit also has a commercial lending operation, which caters to light truck fleets and heavy trucks. Ford wants to make it as easy as possible for the consumer to be able to drive a

Ford. There are so many different financing options that are offered, that finding a plan that is right for you has become easier than ever. If buying a new vehicle is not financially possible, then Ford also offers a whole line of pre-owned vehicles, which are backed by Ford Motor Company with a 100 point inspection.

Distribution Internet Marketing

Ford's newest website for Ford division cars and trucks is www.fordvehicles.com. The new website allows perspective customer to compare Ford vehicles to other cars made by other manufacturers. They are the first company to give consumers the option of product comparison. The section of product comparison on the website comes complete with photographs, feature description, safety options, competitive pricing, financing and warranty information. Ford division internet coordinator, Trisha Habucke states, "With our new design we incorporated new technologies that deliver more visually exciting content." The website is so user friendly that consumers can just go right from one Ford vehicle to the next without any trouble. Ford is committed to bringing their customers total brand experience.

For example, Ford knows that people with certain types of personalities are attracted to certain types of cars. Explorer drivers, for example are rugged, the "No boundaries-ford outfitters" slogan appeals to them. When Ford began their internet market, they did the most extensive research even conducted by a car company. Their advertising agency, J.Walter Thomson found that 210 test participants concurred that the Ford website deserved a high rating for its complete content. Ford attributes a fair amount of the success to the internet. The internet is a way to reach millions of people. The company realizes that is has a powerful tool in the internet. Erin Hughes, who is a Ford employee since 1999, admits that her greatest tool is the internet. Erin's regional manager realized that if they had one person whose sole job was to be dedicated to the internet, the company would prosper.

Erin later became the first internet customer satisfaction coordinator. In addition, Hughes started the first internet club for Ford dealers. Since the position of internet coordinator was now more common at Ford motor companies, once per month all of the internet coordinators get together to share their most recent e-commerce news and best practices. Hughes says "my job is to provide our dealers with the resources and technology needed to help them sell more vehicles on main street and E-street". Advertising also plays a large role in the distribution of Ford motor company's products. Ford advertises on television quite often and also on the radio. Previous slogans that Ford had etched in everyone's minds include things like "Have you driven a Ford lately?" with a catchy little tune along with it. Ford also has their slogans and products photographs on major highway billboards across the county as well as scoreboards at sporting events such as during commercial breaks where the broadcaster will say something along the lines of sponsored by Ford Motor Company.

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The Ford Motor Company has come a very long way, since Henry Ford first established it. They went from a little wagon shop to the second leader in automotive sales. They have been around for almost a century. Ford has elaborative marketing strategies as well as distribution strategies. Their website was extremely easy and fun to use. Ford is also a very well rounded company in that they are very environmentally concerned. It is nice to see that people realized, if we don't save our planet now there will be nothing left for future generations. With Ford's experience and high understanding of, and ambition for the satisfaction of the customer, can they some day be the number one automobile company, beating out the General Motor Corporation?

Questions

1. Asses the reasons for the growth of the Ford Company.
2. Interpolate from the case the clout that the company has in the world economy.
3. Assess from the consumer's perspective the performance of the company's product.

Source: *Docstoc.com*

2.9 SUMMARY

- Statistical quality control is a broad term that often describes probability tools used by quality professionals. For example, a company may use acceptance sampling to determine if a group of products is acceptable.
- The major feature of statistical quality control is that instead of measuring defects and adjusting operating parameters to avoid them, the manufacturing engineer measures operating parameters to determine the statistical properties that the process exhibits over time.
- In 1924, Walter A. Shewhart of the Bell Telephone Laboratories laid the foundation for statistical quality control. Since then, the area of SQC has been enriched by the work of numerous statisticians, quality philosophers, and researchers.
- Quality planning involves identifying which quality standards are relevant to the project and determining how to satisfy them.
- Quality management includes the processes required to ensure that the project will satisfy the needs for which it was undertaken. It includes "all activities of the overall management function that determine the quality policy, objectives, and responsibilities and implements them by means such as quality planning, quality control, quality assurance, and quality improvement, within the quality system".

- Commonly used in the manufacturing process, statistical process control (SPC) makes use of statistical facts gleaned through statistical analysis to both monitor and control virtually any process where output can be measured.
- Acceptance sampling is done on sample's post production to check for quality parameters as decided by the organization covering both attributes as well as variables.
- Quality assurance (QA) is a process-centered approach to ensuring that a company or organization is providing the best possible products or services.
- The zero defects approach focuses managerial attention upon ensuring that processes are within acceptable deviations from targets, for example, plus or minus 0.001 millimeter thickness.

2.10 KEY TERMS

- **Statistical quality control:** Statistical quality control is the observation of variables of a manufacturing process over time and the application of statistical analysis of those variables to define operating windows that yield lower defect products.
- **Quality planning:** Quality planning involves identifying which quality standards are relevant to the project and determining how to satisfy them.
- **Quality policy:** Quality policy is "the overall intentions and direction of an organization with regard to quality, as formally expressed by top management".
- **Benchmarking:** Benchmarking involves comparing actual or planned project practices to those of other projects in order to generate ideas for improvement and to provide a standard by which to measure performance.
- **Checklist:** A checklist is a structured tool, usually industry- or activity-specific, used to verify that a set of required steps has been performed.
- **Acceptance sampling:** Acceptance sampling is done on sample's post production to check for quality parameters as decided by the organization covering both attributes as well as variables.
- **Quality assurance (QA):** Quality assurance (QA) is a process-centered approach to ensuring that a company or organization is providing the best possible products or services. It is related to quality control, which focuses on the end result, such as testing a sample of items from a batch after production.

2.11 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Statistical quality control is the observation of variables of a manufacturing process over time and the application of statistical analysis of those variables to define operating windows that yield lower defect products.

2. Continuous improvement refers to efforts to bring more and more of the process under statistical quality control, including upstream activities, such as raw material sourcing and pre-acceptance testing.
3. Quality planning involves identifying which quality standards are relevant to the project and determining how to satisfy them.
4. The scope statement is a key input to quality planning since it documents major project deliverables as well as the project objectives which serve to define important stakeholder requirements.
5. True
6. False
7. False
8. True
9. True

2.12 QUESTIONS AND EXERCISES

Short Answer Questions

1. Define statistical quality control.
2. What do you mean by quality planning?
3. State the meaning of acceptance planning.
4. Define quality assurance.
5. What are the key inputs to quality planning?
6. Identify the major outputs of quality planning.
7. Define control chart.

Long Answer Questions

1. Describe the fundamentals of SQC.
2. Discuss the evolution and objectives of SQC.
3. What are the key tools of statistical process control?
4. Discuss the meaning and importance of Zero Defect Manufacturing.
5. What are the key tools and techniques for quality planning?
6. Write a detailed note on acceptance sampling planning.
7. What are the key elements and significance of quality process?

UNIT 3 QUALITY ECONOMICS

Structure

3.0 INTRODUCTION

Whenever we talk about economics of quality, two things come to our mind i.e. what are the benefits, and what are the costs of quality? In other words, what are the benefits and costs involved in introducing, adopting or implementing a quality system? Hence, cost of quality is the main focus of this unit. Nevertheless, we shall begin with a recapitulation of benefits of quality. We will discuss the various types of quality costs. We will explore the relationship between quality and productivity and also highlight the need for quality cost system.

Morse explains that there is an inverse relationship between prevention and appraisal costs and internal and external failure costs (See figure 3.1). Therefore, spending money on prevention can reduce the costs of internal and external failure. This relationship works in the other direction as well. If less is spent on prevention, then more failure costs will be incurred.

In addition, the author points out another relationship between the two main types of costs. If a company spends little money on prevention, it is likely that the company will have low internal failure costs and high external failure costs. This is due to the fact that "all defects are going out of the door" (p. 17). This means that goods are leaving the factory in bad condition, but the company is not realizing

this before they leave. Therefore, the customer gets a bad product, which, in turn, leads to external failure costs for the company. This is where inspection, as a part of prevention, is an important tool.

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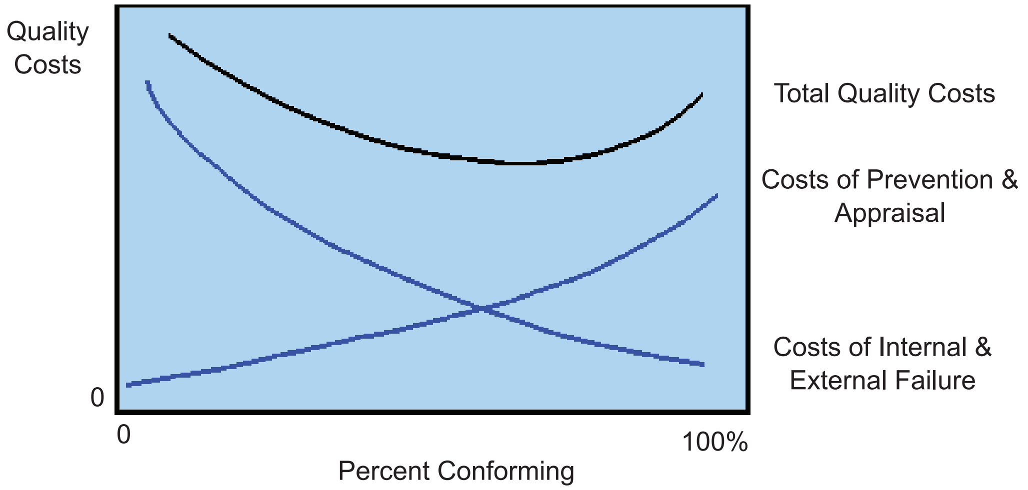


Fig. 3.1: Economics of Quality of Conformity

3.1 UNIT OBJECTIVES

After going through this unit, you will be able to:

- Discuss the concept of quality and cost and quality and productivity
- State the benefits of quality
- Describe competition in quality
- Discuss quality as competitive advantage
- Describe the role of MNCs in emergence of global quality.

3.2 QUALITY AND COST

The goal of any quality cost system is to reduce quality costs to the lowest practical level. This level is determined by the total of the costs of failure and the cost of appraisal and prevention. Juran and Gryna (1988) present these costs graphically as shown in Fig. 3.2. In the figure it can be seen that the cost of failure declines as conformance quality levels improve toward perfection, while the cost of appraisal plus prevention increases. There is some target quality level where the sum of prevention, appraisal, and failure costs is at a minimum. Efforts to improve quality to better than the optimum level will result in increasing the total quality costs.

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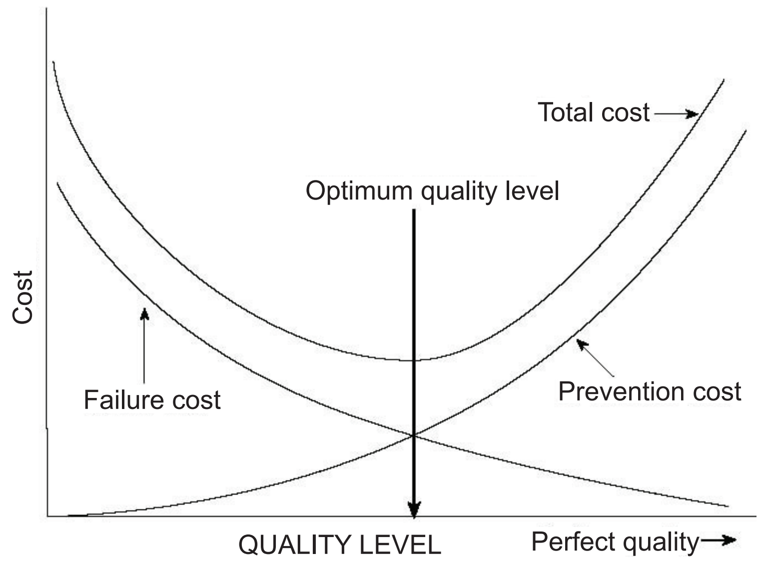


Fig. 3.2: Classical model of optimum quality costs

Source: Adapted From Jurans Quality Control Handbook, 4th edition. J.M. Juran, editor.

Juran acknowledged that in many cases the classical model of optimum quality costs is flawed. It is common to find that quality levels can be economically improved to literal perfection. For example, millions of stampings may be produced virtually error-free from a well-designed and built stamping die. The classical model created a mindset that resisted the idea that perfection was a possibility. No obstacle is as difficult to surmount as a mindset. The new model of optimum quality cost incorporates the possibility of zero defects and is shown in Fig. 3.3.

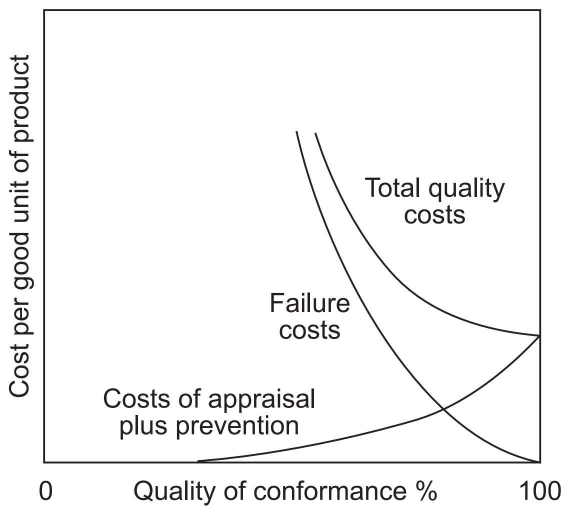


Fig. 3.3: New model of optimum quality costs

Source: From Jurans Quality Control Handbook, 4th edition. J.M. Juran, editor

Quality costs are lowered by identifying the root causes of quality problems and taking action to eliminate these causes. The tools and techniques described in

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part A of this chapter are useful in this endeavor. Kaizen, reengineering, and other continuous improvement approaches are commonly used.

3.2.1 Quality-Related Cost

Quality-related costs are costs incurred by an organisation to ensure that the products or services it provides conform to customer requirements. In others words, quality costs are the sum of money spent on ensuring that customer requirements are met and also the costs wasted through failing to achieve the desired level of quality. Quality cost is thus the cost of not meeting the customers' requirement i.e. the cost of doing things wrong. The quality cost equals actual cost minus no failure cost. That is, the cost of quality is the difference between the actual cost of making and selling products and services and the cost if there were no failures during manufacture or use and no possibility of failure.

As defined by Philip B. Crosby in his book *Quality Is Free*, the cost of quality has two main components: the cost of good quality (or the cost of conformance) and the cost of poor quality (or the cost of non-conformance).

- The cost of poor quality affects:
  - Internal and external costs resulting from failing to meet requirements.
- The cost of good quality affects:
  - Costs for investing in the prevention of non-conformance to requirements.
  - Costs for appraising a product or service for conformance to requirements.

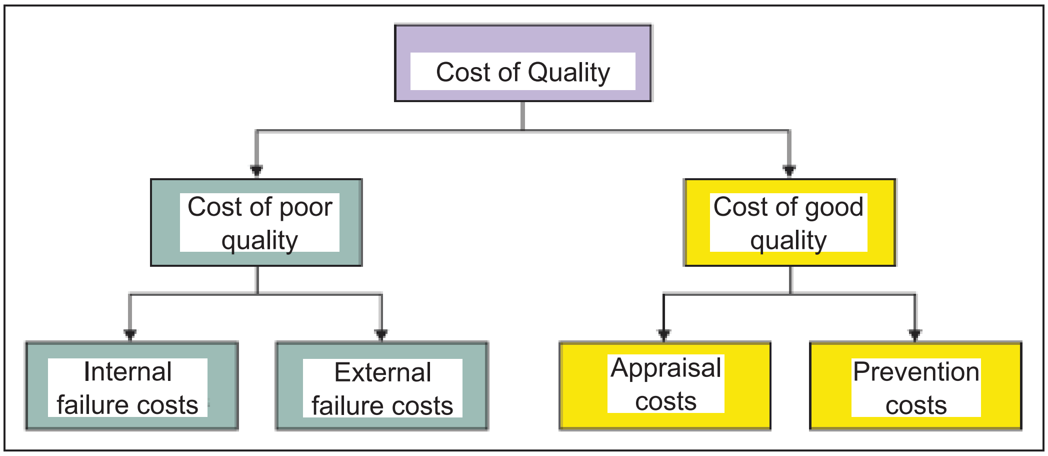


Fig. 3.4: Cost of Quality

TQM philosophy adherents have defined quality costs as costs incurred in excess of those that would have been incurred if the product was built or service performed exactly right the first time. Costs would include not only those that are direct, but also those that result from lost customers, lost market share and the many hidden costs and foregone opportunities not identified by the cost accounting system. Faigenbaum

is attributed with having developed the quality cost measurement while working in the General Electric Company in the 1950s. He proposed a system of Quality Cost Reporting whereby all relevant costs were categorised into four major areas:

- Prevention costs
- Appraisal costs
- Internal failure costs
- External failure costs

Prevention costs

Prevention costs relate to efforts to prevent failures. These are the costs that are incurred on preventing a quality problem from arising. The cost of planning, introduction and maintenance of a quality system, and costs of any action taken to investigate, prevent or reduce non-conformities or defects would be included in this category. It is expected, and reasonably so, that expenditure incurred on prevention would reduce all other costs.

Appraisal costs

Appraisal costs relate to testing, execution and examination to assess whether specified quality is being maintained. These are the costs that are incurred in assessing that the products or service conform to the requirements. This category would include costs incurred on testing of raw materials, parts and components and other goods received on purchase from outsiders, and all inspection and testing during production. Appraised costs can be contained or reduced when there is emphasis on quality improvement.

Cost of appraisal includes

1. Verification – of incoming materials, process-set up, first offs, running processes, intermediates, final products and services, and includes product or service performance appraisal against agreed specifications.
2. Quality audits – to check that the quality system is functioning satisfactorily.
3. Inspection equipment – the calibration and maintenance of any equipment used in appraisal activities.
4. Vendor rating – the assessment and approval of suppliers of all products and services.

Internal failure costs

Internal failure costs (or losses) arise due to internal failures. Such costs result from a product or service failing to meet the quality requirement prior to delivery. These costs arise within the organisation because of the failure to achieve the specified quality, before transfer of ownership to the customer. Such costs are incurred because something was not done right the first time. In theory such costs would disappear if

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there were no internal defects such as scrap, or there was no need for rectification or redesign, or there were no delays in the production process due to non-conformance and non-conformance generated shortages. Internal failure costs are the easiest ones to identify and examine for quality cost reduction.

Internal failure includes

Scrap	-	Defective product which cannot be repaired, used or sold
Re-work or rectification	-	The correction of defective output or errors to meet the required specification
Re-inspection	-	The re-examination of output which has been rectified
Down-inspection	-	Product which is usable but does not meet specifications and may be sold as 'Second Quality' at a low price
Waste	-	The activities associated with doing unnecessary work or holding stocks as the result of errors. Poor organisation, the wrong materials etc.
Failure analysis	-	The activities required to establish the causes of internal product failure

External failure costs

External failure costs arise from the rejection of the products or services by the customers due to poor quality. These are the costs that arise outside the organisation, i.e. after the transfer of ownership to the customer, because of failure to achieve the quality specified. Such costs would not appear if there were no external defects, warranty claims, replacement costs, etc. While estimating/calculating such costs, one must be a little cautious as quantification may not reflect the full story. There are losses such as customer goodwill or future loss of sales which are difficult to estimate and can easily escape from being quantified (the latter type of costs are also known as indirect costs which are further explained a little later). External failure cost can be reduced by more rigorous checking/inspection/testing, which might increase internal failure costs as more failures are detected in-house.

External failure include

Repair and servicing	-	Either of returned products or those in the field.
Warranty claims	-	Failed products which are replaced under guarantee.
Complaints	-	All work associated with servicing of customers' complaints.

Returns	-	The handling and investigation of rejected products and service including the transport costs.
Liability	-	The result of product liability, litigation and other claims, which may include changing contact.
Loss of goodwill	-	The impact on reputation and image which impinges directly on future prospects for sales.

3.2.2 Measuring Cost of Quality

Cost of quality is a measure used when describing the cost of waste or business losses resulting from poor process or product quality control. The cost of quality measure is designed to be a benchmark to compare products or processes, or to track the changes to a product or process over time. The measure is also used to demonstrate the value of process and product quality control. Cost of quality is an aggregate measure that incorporates many individual processes or product quality measures into one value.

Instructions

- Define the product, products, process or processes being measured. This allows the focus of measurement efforts to have a specific scope. The defined scope ensures the measures taken relate directly to the intended products or processes.
- Identify components of four measurement areas. Internal, external, preventative or assessment costs of quality may be used to compile a total cost of quality. Each of the four areas of measurement may be individually identified, or they may all be addressed. For example, if a business or organization is interested in the cost of quality for internal process problems, the scope of the project is focused on understanding only that area. It is not necessary to scope the cost of quality for all four measures. Many measures (such as customer impact) may be difficult to quantify.
- Identify the costs which directly affect the selected scopes. Measures can be divided into two basic areas. Direct costs, which affect actual profits, and indirect costs which only indirectly affect profits. Direct costs are those associated with goods, salaries, consumables and materials and directly affect the dollar costs of running a business or the profits gained. Indirect costs are those associated with productivity, and typically do not directly affect the accounting of an organization. For example, if a salaried worker spends one hour a day waiting for meetings to begin, the lost hour of time is considered an indirect cost. Identifying waste or losses is required to generate a valid metric.

- List all the measures to be captured. Once lists of potential costs resulting from poor process or product quality are defined, the data should be gathered. Each measurement should be as accurate as possible, and the actual cost of the project may be included in the cost of quality measurement (as it is a direct result of ongoing quality investigations).
- Compile the measurements to provide a cost of quality metric. The cost of quality metric compiled may be used to provide a benchmark or an ongoing measure from which all future measurements will be garnered. While it is not essential to keep the measures completely static, if the measures are sufficiently broad at original scoping, the cost of quality metric may become a valuable tool by which an organization gauges process or product quality control.

Problems in Quality Cost Measurement

Major problems faced by a company while measuring the cost of quality improvement are enumerated below:

- The difficulty in measuring and quantifying certain quality parameters such as the customer loyalty, staff commitment, product reputation, true cost of errors in the organisatoin which are not always recorded or the improved workmanship of the properly trained employees.
- There is apparently subjective nature of classification of quality costs. Therefore, the importance of establishing a consistent company – wide view of the various quality costs increases.
- The technical accounting problems of a cost measurement system which by definition is incomplete (not all costs within an organisatoin are classified as quality costs) and therefore, does not produce a balanced account which would permit validation.
- The difficulty in apportioning overheads across the quality cost categories. This represents a fundamental problem as the overhead activities (such as management time spent on correcting errors and troubleshooting) are often the way quality costs. The moves towards activity-based system may improve this particular difficulty.

3.2.3 The Six Sigma Philosophy of Cost of Quality

What is the relation between the cost of good quality and the cost of poor quality? The traditional view would be to conclude that if a company wants to reduce defects and by this reduce the cost of poor quality, the cost of good quality would have to be increased, meaning higher investments in any kind of checking, testing, evaluation, training of operators, etc. Following the six sigma philosophy, however, of building quality into process, service and products and doing things right the first time, the increase of the cost of good quality, while striving for zero defect performance, can be smoothened if processes get better.

As Fig. 3.5 shows, business processes with better process sigma will have significantly lower prevention and appraisal costs. Although you will never fully eliminate appraisal and prevention costs (as opposed to failure costs that in an ideal zero defect world would also be zero), their reduction due to better process performance will be significant.

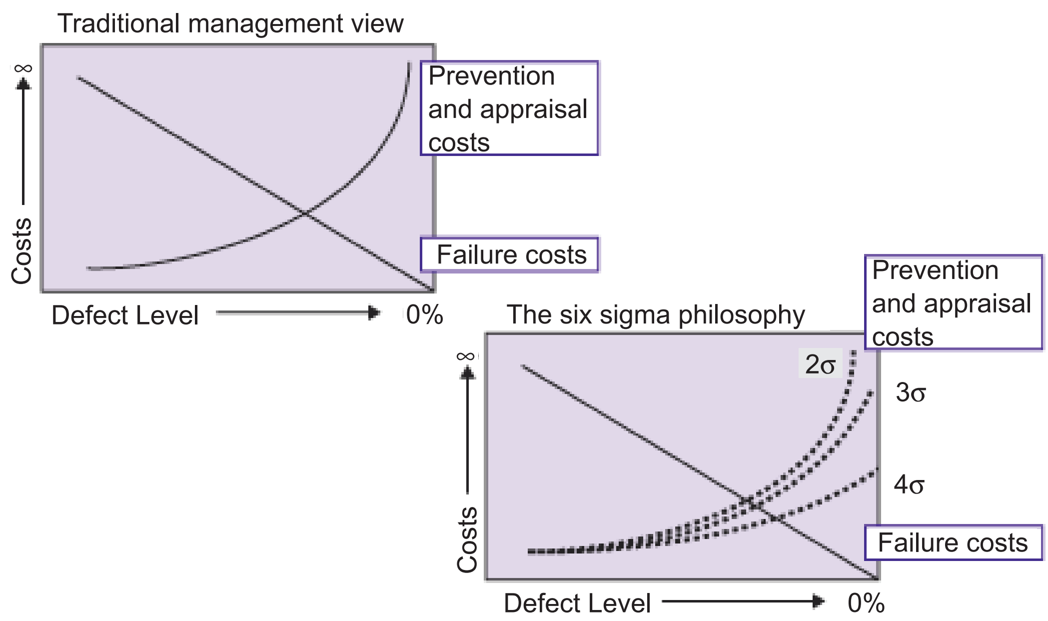


Fig. 3.5: Traditional Management View vs. Six Sigma Philosophy

Table 3.1 shows how dramatically the cost of quality as a percentage of sales decreases if the process sigma improves.

Table 3.1: Sigma Level and the Cost of Quality

Sigma Level	DPMO	Cost of Quality as Percentage of Sales
2	298,000	More than 40%
3	67,000	25-40%
4	6,000	15-25%
5	233	5-15%
6	3.4	Less than 1%

Assuming that the average performance of a company is 3 sigma, 25 percent to 40 percent of its annual revenue gets chewed up by the cost of quality. Thus, if this company can improve its quality by 1 sigma level, its net income will increase hugely.

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Case Study of Eastman Kodak: Secret of Success in Business

Kodak is one of the oldest companies in the photography market, established more than 100 years ago. This was the iconic, American organization, always in the position of the leader. Its cameras and films have become known all over the world for its innovations. Kodak's strength was its brand – one of the most recognizable resources, that enabled creating new technologies.

Kodak is not just selling their still image films, Kodak have quite, number of product lines and services to offer (product diversification), such as digital images, printer cartridges, paper kits and innovative big signboards, which Kodak sells globally. Further, Kodak's quality goal and overall objective is to achieve Total Customer Satisfaction. This is accomplished by utilizing appropriate process improvement techniques (e.g. Zero Defects, Supplier Certification, Lean, Six Sigma, etc.) in a manner that delivers improved productivity and the optimal deployment of resources.

Kodak achieves their objective through the Supplier Quality Process (SQP), which utilizes a number of different elements to improve, measure, and monitor. The flexible design of SQP allows it to be applied to the specifics of each Kodak/supplier relationship. The improvements gained should benefit all suppliers' customers and eliminate unnecessary costs. Furthermore, each supplier is expected to measure their performance in a way that is consistent with Kodak's business needs, and they are responsible for driving continuous improvement within their operations. Effective quality improvement is hardly easy, but if SQP has been deployed well, the following results should occur for both Kodak and suppliers.

- Defective trends will decrease and overall performance will improve.
- Number of supplier "corrective action" requests will decrease.
- Productivity/Cost of Quality (COQ) savings will result.
- Number of certified suppliers will increase.

Element of SQP	Description
Supplier Quality Assessment (SQA)	The purpose of the SQA is to evaluate the effectiveness of the supplier's quality management system, continuous improvement processes, and the supplier's ability to meet ever increasing demands. Assessments take place wherever the product or service is "produced" and are mostly a 1 day in length

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Measuring Supplier Performance	To keep Kodak's suppliers performing at or above the stated levels, a number of criteria are measured including, minimum performance for a quality management system, product or service quality performance measures such as, DPPL, delivery performance. The data that makes up these performance measures is managed in systems such as the Supplier Quality Management System.
Supplier Process and Performance Improvement	Kodak expects the processes and the performance of their supply base to continuously improve from year to year. This is critical for both the supplier and for Kodak to remain competitive in the industry and to exceed standard in quality delievery, cost and reliability.
Supplier Certification	Kodak's Supplier Certification Program recognizes suppliers, who meet or exceed Kodak established requirements and are producing excellent levels of cost, quality and delivery performance, to be considered for this recognition,
Cost of quality (COQ)	The COQ model is used to quantify, in dollars, quality performance of suppliers by looking at DPPM, delivery, lead times, administrative costs of corrective action and potential line down situations. The model may also be used in benchmarking suppliers in e-auctions and on sourcing activities.

As more people are worried about environmental conditions, Kodak also shows concerns over environment, Kodak begins its mass advertisement in 2005 and manifests their philosophy as environment-friendly relating with ISO's certification on their products, while Kodak also sees their CSR (Corporate Social Responsibility) as environment friendly. Kodak projected their societal marketing strategies, plays an important role towards their products as safe to use.

Kodak products are more appreciated among existing as well as potential and target customers. Kodak Greenhouse Gas (GHG) emissions represent a waste so Kodak has to take action to reduce GHG emissions.

Source: *http://www.mbaknol.com/management-case-studies/case-study-of-eastman-kodak-secret-of-success-in-business/*

3.3 QUALITY AND PRODUCTIVITY

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After companies determine customer needs, they must concentrate on meeting those needs by yielding high quality products at an efficient rate. Companies can improve quality and productivity by securing the commitments of all three levels of management and employees as follows:

1. **Top-level management:** Implement sound management practices, use research and development effectively, adopt modern manufacturing techniques, and improve time management.
2. **Middle management:** Plan and coordinate quality and productivity efforts.
3. **Low-level management:** Work with employees to improve productivity through acceptance of change, commitment to quality, and continually improving all facets of their work.

Productivity is the relationship between a given amount of output and the amount of input needed to produce it. Profitability results when money is left over from sales after costs are paid. The expenditures made to ensure that the product or service meets quality specifications affect the final or overall cost of the products and/or services involved. Efficiency of costs will be an important consideration in all stages of the market system from manufacturing to consumption. Quality affects productivity. Both affect profitability. The drive for any one of the three must not interfere with the drive for the others. Efforts at improvement need to be coordinated and integrated. The real cost of quality is the cost of avoiding non-conformance and failure. Another cost is the cost of not having quality—of losing customers and wasting resources.

As long as companies continually interact with their customers and various partners, and develop learning relationships between all levels of management and employees, the levels of productivity and quality should remain high.

There is a positive relationship between quality and productivity as strongly advocated by Deming. He forcefully argued that reduced productivity was caused by quality defects, rework and scrap. He concluded that "improvement of quality transfers waste of man hours and machine-time into manufacture of quality products and better service". Feigenbaum maintained that a certain 'hidden' and non- productive plant exists to rework and repair defects and returns, and if quality is improved, this hidden plant would be available for increased productivity. It will be seen that these arguments are straightforward. Any quality improvement that reduces defects is, by definition, an improvement in productivity. The cost of quality improvement rarely exceeds the savings from increased productivity. It may be seen that building a case for or against quality improvement based on output or defect reduction alone may be oversimplifying the matter. A more convincing case can be built on the basis of proven benefits of TQM. When the broader picture is considered it can be shown that increasing quality also increases productivity, and the two are

mutually reinforcing. Productivity has come to mean more output for the same or less cost. TQM embraces a broader concept and can be considered to include the benefits of productivity when properly implemented. Greater productivity can also be through attained cost reduction, greater efficiency, better use of resources and organisational restructuring, TQM goes a step further; it is a longer term and more comprehensive approach and is concerned with cultural change by creating vision, mission and values.

3.3.1 Factors Influencing Productivity

Productivity is outcome of several interrelated factors, which may broadly be divided into two categories—human factors and technological factors.

1. **Human Factors:** Human nature and human behaviour are the most significant determinants of productivity. Human factors include both their ability as well as their willingness:
   (a) *Ability to work:* Productivity of an organization depends upon the competence and caliber of its people—both workers and managers. Ability to work is governed by education, training, experience, aptitude, etc. of the employees.
   (b) *Willingness to work:* Motivation and morale of people are very important factors that determine productivity. These are affected by wage incentive schemes, labour participation in management, communication systems, informal group relations, promotion policy, union management relations, quality of leadership, working hours, sanitation, ventilation, subsidized canteen, company transport, etc.
2. **Technological Factors:** Technological factors exert significant influence on the level of productivity. These include the following:
   (a) Size and capacity of plant
   (b) Product design and standardization
   (c) Timely supply of materials and fuel
   (d) Rationalization and automation measures
   (e) Repairs and maintenance
   (f) Production planning and control
   (g) Plant layout and location
   (h) Materials handling system
   (i) Inspection and quality control
   (j) Machinery and equipment used
   (k) Research and development
   (l) Inventory control

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3. **Managerial Factors:** The competence and attitudes of managers have an important bearing on productivity. In many organizations, productivity is low despite latest technology and trained manpower. This is due to inefficient and indifferent management. Competent and dedicated managers can obtain extraordinary results from ordinary people. Job performance of employees depends on their ability and willingness to work. Management is the catalyst to create both. Advanced technology requires knowledgeable workers who in turn work productively under professionally qualified managers. No ideology can win a greater output with less effort. It is only through sound management that optimum utilization of human and technical resources can be secured.
4. **Natural Factors:** Natural factors such as physical, geographical and climatic conditions exert considerable influence on productivity, particularly in extreme climates (too cold or too hot). Natural resources like water, fuel and minerals influence productivity.
5. **Sociological Factors:** Social customs, traditions and institutions influence attitudes towards work and job. For instance, bias on the basis of caste, religion, etc., inhibited the growth of modern industry in some countries. The joint family system affected incentive to work hard in India. Close ties with land and native place hampered stability and discipline among industrial labour.
6. **Political Factors:** Law and order, stability of Government, harmony between states, etc. are essential for high productivity in industries. Taxation policies of the government influence willingness to work, capital formation, modernization and expansion of plants etc. Industrial policy affects the size, and capacity of plants. Tariff policies influence competition. Elimination of sick and inefficient units also helps to improve productivity.
7. **Economic Factors:** Size of the market, banking and credit facilities, transport and communication systems, etc. are important factors influencing productivity.

3.3.2 Role of Technology

The relationship between advanced technology and productivity has been a matter of great debate and dicussion. Japanese success is mainly attributed to advanced technology. However, it is a mistake to consider technology to be the only answer to improvement in quality and productivity. It is not merely labour replacement which leads to more productivity, it is rather improvement in processes which is important and causes an upward thrust in productivity. Many people think of technology as automation, mechanisation, machines and computers but the term has a much broader meaning. It is a means of transforming inputs into outputs. Technology thus includes methods, procedures, and techniques which enable this transformation. It includes both machines and methods. The latter improves processes which improve the output/input ratio.

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Many firms have achieved remarkable increases in both quality and productivity with little or no investment in the hardware side of technology. This is however not to discount the use of hardware to improve both quality and productivity. However, automation and machines require capital investment, whereas management systems do not demand/require that much capital and may be equally or more effective. The solution in several cases may lie in improving the systems and processes rather than in introducing new technology. Honda was able to market a more competitive car than General Motors' Saturn by controlling cycle time and processes. Honda took half as long General Motors took (eight years). The tendency is to focus on technology to reduce labour costs and to overlook the improvement in quality that can be achieved through improvement in related processes and tapping the potential of the workforce.

Good companies buy technology to improve products, reduce lead time, boost quality and increase flexibility. Experience has shown that frontline supervisors and employees have a wealth of innovative ideas for productivity and quality improvement. What a firm requires is proper systems, procedures and a right climate to harness their talent. The historical focus of cost reduction in the present context may not be adequate. In today's context capital outlay decisions must be based on overall productivity, improving the quality, cutting cycle time, redesigning inventory and adding flexibility. Activity analysis, and activity based costing (ABC) can be useful tools in improving management systems. We shall turn to these tools in a subsequent section.

3.3.3 Significance

Benefits derived from higher productivity are as follows:

1. It helps to cut down cost per unit and thereby improve the profits.
2. Gains from productivity can be transferred to the consumers in form of lower priced products or better quality products.
3. These gains can also be shared with workers or employees by paying them at a higher rate.
4. A more productive entrepreneur can have better chances to exploit export opportunities.
5. It would generate more employment opportunities.

3.4 BENEFITS OF QUALITY

Quality leads to several benefits for the organisation is no longer a matter of dispute. However, benefit aspects of quality need reiteration/recapitulation. If the customers perceive that the product of a particular company is relatively of better quality than the products of the competitors, this in itself is a single most important point that may

Check Your Progress

1. What is the goal of a quality cost system?
2. Define quality cost.
3. What are the key causes of external failure cost?
4. Define productivity.

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affect the long-term performance of the company. While there are several benefits which can be quantified, there are several others which are hard to quantify. However, it is generally concluded that 'quality-related benefits' reach far beyond those which are calculable from immediate data relating to success or failure in conformance to specific quality criteria. Many studies have been done examining the relationship between quality, productivity and market share. The unequivocal conclusion of the studies is that quality drives market share. When superior quality and market share are both present, profitability is virtually guaranteed. There is a strong relationship between perceived quality and profitability. Quality pushes growth. It can reduce costs which provide a competitive edge. There are two types of quality: customer-driven (or external) quality, and conformance (or internal specification) quality. The latter relates to appropriate product specifications and service standards that lead to cost reduction. There is an inverse relationship between internal or conformance quality and costs. That is why perhaps Crosby coined the phrase "quality is free". As quality improves, the cost of the conformance improves, resulting in improved market share and hence profitability and growth. This, in turn, provides a stimulus for further investment in quality improvement areas such as research and development. The cycle thus goes on. In short, improving both internal (conformance) quality and external (customer perceived) quality not only lowers the cost of poor quality or no quality, but also serves as a driver for growth, market share and profitability. The rewards of higher quality have been found to be positive, substantive and pervasive.

The following organisational benefits are often attributed to a quality improvement programme:

- Increased market share
- Greater customer loyalty i.e. customer retention
- Higher (stock market) share prices
- Higher prices for products/services
- Greater productivity
- Accelerated development of new products and their introduction in the market
- Enhanced employee morale and retention
- Cost-effective use of resources (cost reduction)
- lmproved profitability

If TQM programmes do not make significant impact on or are not followed by tangible results in terms of the competitiveness of the firm, the fault must lie somewhere else, and not with the programme per se. An important fact to recognise is that in general the benefits do not and cannot happen overnight. Evidence suggests that achieving success is a slow process. Japanese companies such as Honda, Nissan and Toyota, which are acknowledged leaders in quality management, have had a long experience (of nearly 30 years or so) in implementing quality approach.

Employee empowerment is one of the characteristics of a successful TQM programme. Giving power down the line to the employee level means taking powers away somewhere else in the organisation which is not easy to come by. A survey of UK companies with fewer than 500 employees showed that almost a half had increased their profitability as a result of registration to BS5750 (A Survey of Quality Consultancy Scheme Plans 1989-90). That quality-related benefits arise from consumer-based transactions is well-known. However, benefits may also flow from transactions between organisations, and from transactions within an organiation. According to the transactional model, where buyer and seller are involved in a transaction, quality is a subject of bargaining process in which the other parameters are delivery and cost. This process forms a part of what has been described as an 'adversarial' relationship between buyer and seller, a process in which competitive tendering on pricing and dealing at arm's length with more than one (rather many) suppliers is often a feature. But changing times have necessitated a reappraisal of this traditional model. Gradually, a realisation has dawned on the companies that they cannot be competitive if the components and parts that they buy from suppliers are of inferior quality or are steeped in unreliable supply, even though they may be priced competitively. This has the effect of creating a net cost disadvantage rather than an advantage. Experience has convinced many companies in Japan that they need to develop a closer relationship with their suppliers, which should be characterised by a greater degree of trust and freer exchange of information (both technical and commercial). Obviously, the more collaborative relationship cannot be maintained easily with several competing companies because of the (i) costs and efforts involved in establishing such a relationship, and (ii) the costs and efforts of sustaining that relationship in the long run.

3.5 COMPETITION IN QUALITY

Revolutionary fervor does fade. So does the uniting value of quality which provides the inspiration. But the need for improvement and the energy behind it will always be needed, so the leader has to find ways of continuing the stimulus and excitement of improvement, year on year, decade on decade. Quality itself may no longer be the focus. Quality becomes the foundation, the base from which new initiatives are spawned. Quality, by this stage, is well embedded in the way things are done. No longer is it viewed as an act of faith but as a direct contributor to business results. People know what the quality way is and would not think of compromising the standards established. In this scenario, the leader needs to put the focus on new initiatives which maintain the energy level. In going beyond quality, the focus should provides new stimulation, new challenges and new targets but at the same time reinforce what has been achieved already.

In is difficult to generalize on what these initiatives for the advanced company should be: they are invariably specific to the company and its environment. But

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most of the world's leading companies are tending towards similar practices as they continue their relentless drive for improvement. Thus, one company may have a two-year major push on time-based competitiveness; another may introduce the concept of total produce maintenance; yet another might fashion an improvement focus around a service charter. The initiative might be unique, it might the borrowed from someone else; it might be pioneering or catching up on what others have done. That is not important. What is important is that the improvement energy build up with the quality process is kept high and that the initiatives are chosen to continue the process of business improvement.

The Relationship between Quality and Competitiveness

- At each successive level of competition, the quality of the competitors has increased.
- In business, the competition has now moved from local, regional or national level to international level, which is making it tougher day by day.
- Now only those companies which are able to produce world-class quality can compete at the international level.
- It is extremely important for a country's business to be able to compete globally. When they can't, jobs are lost and the quality of life in that country declines correspondingly

Factors Inhibiting Competitiveness

Business/Government-Related Factors

- Emphasis on short-term profits fed by fear of unfriendly takeover attempts and pressure from lenders or shareholders.
- Excessive medical costs.
- Excessive costs of liability inflated by lawyers working on contingency fees.
- To overcome these business-related inhibitors, it requires business and government to work together in a positive, constructive partnership to enact policies that will reduce the non-value added costs to a minimum.

Family-Related Factors

- Human resources are a critical part of the competitive equation. The more knowledgeable, skilled, motivated, and able to teach members, the better the labor pool will be.
- Family background plays an important role in basic education of the kids. The countries with strong family values are found to be better in educating their kids and hence producing knowledgeable and smart workers.

Education-Related Factors

- The quality of a country's education system is a major determinant of the quality of its labor pool. The higher the quality of the labor pool, the higher the quality of entry-level employees.

3.6 QUALITY AS COMPETITIVE EDGE

Quality as a competitive advantage is seen as one of the fundamental ways in which both individual businesses and national economies can successfully compete in the global marketplace. It contrasts with comparative advantage, which, until the mid-1980s, was seen as a key method of facilitating trade and economic growth. Competitive advantages are those resources that allow a business entity to develop and maintain an edge over competitors who produce similar goods and services. The competitive advantage differs from the comparative advantage, in that the focus is often more on the strategies and skills involved, and less on the resources and final cost of production. A competitive advantage may be achieved by a brilliant public relations strategy, a unique mode of production, or the addition of some benefit that goes above and beyond the benefits offered by similar products on the market. Comparative advantage focuses on businesses or nations producing those goods and services at which they are most efficient, and trading these for products that can be made more efficiently in other nations. While considered mutually beneficial, comparative trade did not directly take into account quality as a competitive advantage and instead focused on the cost of producing goods instead of their final viability and durability once completed.

All competitive industry tries to distinguish itself through the manipulation of several key factors. These include the price charged for goods and services, convenient locations from which they can be provided, and by establishing a loyal customer base. Where quality as a competitive advantage comes into play is in a background or supporting role, as it has a direct impact on every other aspect of a business strategy. A premium price can be charged for goods that are based on perceived superior quality, and this creates a tendency for customers to be naturally loyal to a brand, facilitating more rapid expansion than competitors can attain in the same industry. Quality also adds an element of strategic advantage to businesses as it negates most negative feedback and returns from customers, and reduces both scrap and rework expenses in the manufacturing process.

In a 2011 survey, 70% of 3,400 small- and medium-sized businesses in 34 different national economies rated quality as a competitive advantage. Unique exceptions in India and China were noted, with Indian businesses also rating quality as very important, but placing more emphasis on brand recognition and price than elsewhere. In the Chinese firms surveyed, only 46% rated quality as being of top concern in being competitive, which may not be surprising as China has made a name

for itself internationally for being more competitive on price than most products from other economies. China also remains an exception to the rule as it has continued to find success globally by focusing on comparative advantage for its goods and services. Nations where businesses rated quality as a competitive advantage more highly than elsewhere in the world included 84% of Latin American businesses surveyed considering it most important, and 92% in Vietnam as well as 85% in Taiwan considering quality as extremely important to business success.

A more complex look at quality as a competitive advantage in the business environment gets into what is known as Quality Function Deployment (QFD). QFD attempts to break down quality into both positive and negative aspects as a guide for businesses to focus their efforts on positive quality advantages over all else, as this is seen as a stronger driver for building up the company. An example of negative quality aspects that can be inordinately focused on by businesses includes dealing with disappointed customers to an excessive degree. Instead, if a business focuses on those customers who are the most pleased with its products or services and finds ways to improve upon this aspect of the business, it is more likely to drive the business forward.

Since quality is a subjective term which can be defined quite differently by business rivals, attempts have been made to break it down into several different objective categories, such as design quality and conformance quality. Design quality is concerned primarily with the functionality and durability of the product in terms of for what the customer actually wants to use it. Conformance quality, on the other hand, focuses on the original intent for which the product was made regardless of the various uses it is put to in the marketplace. Together, the complex aspects of both approaches to looking at products are incorporated into what is known as Total Quality Management (TQM), which must remain customer-centric in order to facilitate the survival and growth of all business endeavors.

3.7 ROLE OF MNCs IN EMERGENCE OF GLOBAL QUALITY

Real life is never the smooth curve as depicted; despite everyone's good efforts inside, the world outside is always trying to throw us off course. Alcatel's Spanish division offers a good illustration of the sheer determination needed to keep pushing up the curve in the face of adversity. A significant part of the gaint Alcatel Alsthom telecoms group, Alcatel Standard Electrical employs 10,000 people across eight major locations. The Alcatel group, headquartered in France, has a mission to be strong in Europe (reporting from national units is already routinely made and Alcatel has applied for a European statute to reflect this emphasis). Number one is Europe in telecoms equipment, in digital switching, in cables and in several other related fields, Alcatel operates a hands-off policy for its national divisions, provided that a

major contribution to this overall position is maintained. This has proved challenging to Alcatel Standard Electrical.

Quality first came on the scene as a quality programmed in 1984. This was level on in quality maturity with all the problems of a well-meaning initiative struggling for life in an indifferent managerial environment. Cristobel Serra, Quality Director, fought hard to keep going, switching the emphasis to development circles with the more sustainable aim of developing people rather than problem-solving. Facilitators were trained to work with middle management and a plan for ISO 9001 accreditation was launched; a shaky level two was reached. As Cristobel now says, 'We started bottom-up but I wouldn't recommend it.

Then came the first reality test from the business. A major restructuring was needed to cope with the technological shift from electro mechanical gear to electronic. Some operations which used to take 16 people now required 0.5. Through the mid-1990s, an astonishing 50 percent of jobs were lost. A new agreement between the Spanish government (who was the major customer and user), the unions and the company was thrashed out to make the new operation viable. Crucially, a new company president was brought in. Still in his thirties at the time, the new president reversed the hierarchical management structure, building units with decision-taking closer to the market, cutting across functions and leading only a tiny head office. But much more than changing the boxes was needed and a total quality programme was devised to bring in a different management style. Bottom-up now became top-down – level three on our maturity scale. Product quality was becoming more reliable by now and the 1,100 inspectors were replaced by a 170 off-line auditors. Customer satisfaction became the stated top priority as total quality training sessions were rolled out to the units. Some took off fast as the local enthusiasts saw their opportunity and took up the empowerment they were being offered. But others were slow to follow, with only a gradual spread across the units as some of the successes became visible. By 1989, three years of total quality has passed and little additional progress was being made, even though all the key elements were there. Alcatel had hit the wall.

A quality task force was set up to find out why. Other programmes were examined and showed that it wasn't really the content. Perhaps it had just stagnated. A relaunch was devised for the middle of 1989. This time it was left to permeate through naturally; simultaneously, a plan was created and resources built up to power through the blockages. A new quality council of all the unit managing directors was established, chaired by the president. Now no one at senior level could opt out; all were held accountable for quality, whether a champion or sceptic. Each unit set up a steering committee from the line management with a trained coordinator in support. The profile for the coordinator was strictly met, with many units having to go outside to meet the requirements. The steering committees appointed improvement teams top-down, made up cross-functionally to address key problems, membership was non-voluntary; 20 hours training in improvement methodology and techniques was

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given to all team members, reaching some 1,600 people in all. Engineers received additional training in specialist techniques and the whole workforce attended three hours of workshop education on the new approach. To reinforce the whole endeavor, a recognition day was in December 1990 to review the team achievements and celebrate the successes of some 550 teams – a great success in is own right and repeated each year since.

Such intensity of effort from 1989 to 1991 took Alcatel through the wall into level four. Management was determined and visibly so. Then came big reality test number two. From 1986 onwards, growth of 30 percent every year had been achieved. This came abruptly to an end when the main customer, the Spanish government, brought the investment in telecoms infrastructure to a premature finish. Suddenly Alcatel's market was dissolving. A new strategy was quickly devised. Manufacturing was revived after a progressive move towards subcontracting. The world was scoured for expert markets. Soon destinations in China and North America were being posted on the electronic information board detailing the big systems being built, but still at the cost of more jobs. This had a double blow effect on the quality process. Morale was low and many people who were strong participants in the teams were leaving.

The leaders did not give up. Rather they redoubled their efforts. People issues came into even sharper focus. Eduardo Motez, one of the managing directors and long committed to the quality process, had been spending 20 percent of his time on quality in one form or another. Now he doubled it. His description of the development teams, which had floursished since the relaunched programme, was 'like mushrooms in England in the autumn – suddenly they are everywhere, then just as quickly they've gone.' He deliberately and visibly invested in more training to show commitment. He rapidly introduced cross-training for people to learn additional skills and soon 60 percent of the workforce had certified skills in two tasks and 15 percent in four tasks. He personally inspired a 'Pride of Team Spirit' campaign and backed it with tangible changes. He introduced music on the factory floor, uniforms, a no smoking rule (very bold in heavy – smoking Madrid) and an open space concept (even trickier: no private offices were allowed in the company at any level). His open-door policy meant he was inundated with visits, mostly to complain about the changes. But the majority stuck with him and the feeling of a new factory began to emerge. The pride returned, improvement activity started to rise again.

Meanwhile at the centre, Cristobel Serra had his best idea yet. The rather adhoc measures that had been in use in the group were superseded by a carefully thought through and well-tested series of metrics. These enable local development teams to link their contribution right back to group strategy. The metrics have been evolved to 23 sharp indicators ranging from competitors' market share to percentage of products delivered without objectives. Today, Eduardo discusses his strategic plan, defined by these indicators, with his whole team in one big meeting before presenting them to his president. The president, in turn, is more interested in the indicators than the

profit and loss account which is submitted with them. He looks particularly at the metrics describing progress on inventory, on people and on customers; he knows these will affect the next profit and loss account.

All in all, Alcatel Standard Electrical has had a good return from its quality process. The process has reached level five in some units such as Eduardo's. One observer, a supplier, expresses amazement that quality still survives, despite restructuring, downsizing and a culture change. Eduardo and Cristobel would say it is only because of the quality process that huge changes have been possible. To go further and this is central to Alcatel's strategy, the business has to look outward. Benchmarking is being established. Assessments to external standards, such as the European Quality Award criteria, are being introduced. Alcatel is one of the growing number of companies which have clearly set their ambitions to achieve world-class standards and this is where it is headed, despite the tests set by reality.

Case Study of KFC: Establishment of a Successful Global Business Model

By mid 1950s, fast food franchising was still in its infancy when Harland Sanders began his cross-country travels to market "Colonel Sanders' Recipe Kentucky Fried Chicken." He had developed a secret chicken recipe with eleven herbs and spices. By 1963, the number of KFC franchises had crossed 300. Colonel Sanders, at 74 years of age was tired of running the daily operations and sold the business in 1964 to two Louisville businessmen – Jack Massey and John Young Brown, Jr. – for $2 million. Brown, who later became the governor of Kentucky, was named president, and Massey was named chairman. Colonel Sanders stayed in a public relations capacity.

In 1966, Massey and Brown made KFC public, and the company was enlisted on New York Stock Exchange. During late 1960s, Massey and Brown turned their attention to international markets and signed a joint venture with Mitsuoishi Shoji Kaisha Ltd. in Japan. Subsidiaries were also established in Great Britain, Hong Kong, South Africa, Australia, New Zealand, and Mexico. In the late 1970s, Brown's desire to seek a political career led him to seek a buyer for KFC. Soon after, KFC merged with Heublein, Inc., a producer of alcoholic beverages with little restaurant experience and conflicts quickly arose between the Heublein management and Colonel Sanders, who was quite concerned about the quality control issues in restaurant cleanliness. In 1977, Heublein sent in a new management team to redirect KFC's strategy. New unit construction was discontinued until existing restaurants could be upgraded and operating problems eliminated. The overhaul emphasised cleanliness, service, profitability, and product consistency. By 1982, KFC was again aggressively building new restaurant units.

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In October 1986, KFC was sold to PepsiCo. PepsiCo had acquired Frito-Lay in 1965, Pizza Hut in 1977 with its 300 units, and Taco Bell in 1978. PepsiCo created one of the largest consumer companies in the United States. Marketing fast food complemented PepsiCo's consumer product orientation and followed much the same pattern as marketing soft drinks and snack foods. Pepsi soft drinks and fast food products could be marketed together in the same restaurants and through coordinated national advertising.

The Kentucky Fried Chicken acquisition gave PepsiCo the leading market share in three of the four largest and fastest growing segments in the U.S., quick-service industry. By the end of 1995, Pizza Hut held 28 per cent share of $18.5 billion, U.S. pizza segment. Taco Bell held 75 per cent of $5.7 billion Mexican food segment, and KFC held 49 per cent of the $7.7 billion, U.S. chicken fast food segment.

Japan, Australia, and United Kingdom accounted for the greatest share of the KFC's international expansion during the 1970s and 1980s. During the 1990s, other markets became attractive. China with a population of over 1 billion, Europe and Latin America offered expansion opportunities. By 1996, KFC had established 158 company-owned restaurants and franchises in Mexico. In addition to Mexico, KFC was operating 220 restaurants in the Caribbean, and in the Central and South America.

Many cultures have strong culinary traditions and have not been easy to penetrate. KFC previously failed in German markets because Germans were not accustomed to take out food or to ordering food over the counter. KFC has been more successful in the Asian markets, where chicken is a staple dish. Apart from the cultural factors, international business carries risks not present in the U.S. market. Long distances between headquarters and foreign franchises often make it difficult to control the quality of individual franchises.

In some countries of the world, such as, Malaysia, Indonesia and some others, it is illegal to import poultry, a situation that has led to product shortages.

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Another challenge facing KFC is to adapt to foreign cultures. The company has been most successful in foreign markets when local people operate restaurants. The purpose is to think like a local, not like an American company.

As KFC entered 1996, it grappled with a number of important issues. During 1980s, consumers began demanding healthier foods, and KFC's limited menu consisting mainly of fried foods was a difficult liability. In order to soften its fried chicken chain image, the company in 1991, changed its name and logo from Kentucky Fried Chicken to KFC. In addition, it responded to consumer demands for greater variety by introducing several new products, such as Oriental Wings, Popcorn Chicken, and Honey BBQ Chicken as alternatives to its Original Recipe fried chicken. It also introduced a dessert menu that included a variety of pies and cookies.

Soon after KFC entered India, it was greeted with protests of farmers, customers, doctors, and environmentalists. KFC had initially planned to set up 30 restaurants by 1998, but was not able to do so because its revenues did not pickup. In early 1998, KFC began to investigate the whole issue more closely. The findings revealed that KFC was perceived as a restaurant serving only chicken. Indian families wanted more variety, and the impression that KFC served only one item failed to enhance its appeal. Moreover, KFC was also believed to be expensive. KFC's failure was also attributed to certain drawbacks in the message it sent out to consumers about its positioning. It wanted to position itself as a family restaurant and not as a teenage hangout. According to analysts, the 'family restaurant' positioning did not come out clearly in its communications. Almost all consumers saw it as a fast food joint specializing in a chicken recipe.

KFC tried to revamp its menu in India. Cole Slaw was replaced with green fresh salads. A fierier burger called Zinger Burger was also introduced. During the *Navaratri* festival, KFC offered a new range of nine vegetarian products, which included *Paneer* burgers. Earlier, KFC offered only individual meals, but now the offerings include six individual meals, two meal combos for two people, and one family meal in the non-vegetarian category. For vegetarians, there are three meal combos for individuals, and meals for couples, and for families.

KFC also changed its positioning. Now its messages seek to attract families who look not only, for food, but also some recreation. Kids Fun Corner is a recreational area within the restaurant to serve the purpose. Games like ball pool, and Chicky Express have been introduced for kids. The company also introduced a meal for kids at ₹ 60, which was served with a free gift.

Over the years, KFC had learned that opening an American fast food outlet in many foreign markets is not easy. Cultural differences between countries result in different eating habits. For instance, people eat their main meal of the day at different times throughout the world. Different menus must also be developed for specific cultures, while still maintaining the core product – fried chicken. You

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can always find original recipe chicken, cole slaw, and fries at KFC outlets, but restaurants in China feature all Chinese tea and French restaurants offer more desserts. Overall, KFC emphasizes consistency and whether it is Shanghai, Paris, or India, the product basically tastes the same.

Questions For Discussion

1. Analyse the case and determine the factors that have made KFC a successful global business.
2. Why are cultural factors so important to KFC's sales success in India and China?
3. Spot the cultural factors in India that go against KFC's original recipe; KFC Fried Chicken.
4. Why did Kentucky Fried Chicken change its name to KFC?

Credit: *Marketing Management-BU (Marketing Management: Text and Cases By S.H.H. Kazmi)*

3.8 SUMMARY

- The goal of any quality cost system is to reduce quality costs to the lowest practical level. This level is determined by the total of the costs of failure and the cost of appraisal and prevention.
- Quality-related costs are costs incurred by an organisation to ensure that the products or services it provides conform to customer requirements. In other words, quality costs are the sum of money spent on ensuring that customer requirements are met and also the costs wasted through failing to achieve the desired level of quality.
- Cost of quality is a measure used when describing the cost of waste or business losses resulting from poor process or product quality control.
- After companies determine customer needs, they must concentrate on meeting those needs by yielding high quality products at an efficient rate.
- Productivity is the relationship between a given amount of output and the amount of input needed to produce it.
- Quality as a competitive advantage is seen as one of the fundamental ways in which both individual businesses and national economies can successfully compete in the global marketplace.

Check Your Progress

Fill in the Blanks

5. A ………… may be achieved by a brilliant public relations strategy, a unique mode of production, or the addition of some benefit that goes above and beyond the benefits offered by similar products on the market.
6. A more complex look at quality as a competitive advantage in the business environment gets into what is known as ……………. .
7. ……………. is concerned primarily with the functionality and durability of the product in terms of for what the customer actually wants to use it.
8. ………… focuses on the original intent for which the product was made regardless of the various uses it is put to in the marketplace.

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3.9 KEY TERMS

- **Quality-related costs:** Quality-related costs are costs incurred by an organisation to ensure that the products or services it provides conform to customer requirements.
- **Appraisal costs:** Appraisal costs relate to testing, execution and examination to assess whether specified quality is being maintained.
- **Cost of quality:** Cost of quality is a measure used when describing the cost of waste or business losses resulting from poor process or product quality control.
- **Productivity:** Productivity is the relationship between a given amount of output and the amount of input needed to produce it.
- **Competitive advantages:** Competitive advantages are those resources that allow a business entity to develop and maintain an edge over competitors who produce similar goods and services.

3.10 ANSWERS TO 'CHECK YOUR PROGRESS'

1. The goal of any quality cost system is to reduce quality costs to the lowest practical level. This level is determined by the total of the costs of failure and the cost of appraisal and prevention.
2. Quality cost is the cost of not meeting the customers' requirement i.e. the cost of doing things wrong. The quality cost equals actual cost minus no failure cost.
3. External failure costs arise from the rejection of the products or services by the customers due to poor quality. These are the costs that arise outside the organisation, i.e. after the transfer of ownership to the customer, because of failure to achieve the quality specified.
4. Productivity is the relationship between a given amount of output and the amount of input needed to produce it.
5. Competitive advantage
6. Quality Function Deployment (QFD)
7. Design quality
8. Conformance quality

3.11 QUESTIONS AND EXERCISES

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Short Answer Questions

1. Define quality cost.
2. What are the key benefits of quality?
3. State the meaning of productivity.
4. What do you mean by appraisal cost?
5. What is internal failure cost?

Long Answer Questions

1. Discuss the relationship between quality and cost.
2. What are the different types of quality cost?
3. What are the key factors influencing productivity?
4. Discuss the role of technology in quality management.
5. What are the key benefits of quality?
6. Discuss the role of MNCs in the emergence of global quality.

UNIT 4 QUALITY SYSTEM

Structure

4.0 INTRODUCTION

Quality systems and their procedures complement an organization and drive the company forward. Through implementation in the form of quality programs, a quality system mobilizes and energizes an organization and its people. The individual employee becomes directed toward quality performance in the context of the organization. Under the systems viewpoint, people external to the organization, such as consumers, suppliers and government representatives, also enter the team and movement for quality. Customers of course, play an important role in Spec quality, either through contracting before production or in test marketing. Contracting customers often impose quality assurance standards and supervise their suppliers and subcontracts.

Organisations will benefit from establishing an effective quality management system (QMS). The cornerstone of a quality organisation is the concept of the customer and supplier working together for their mutual benefit. For this to become effective, the customer-supplier interfaces must extend into, and outside of, the organisation, beyond the immediate customers and suppliers. A QMS can be defined as: "A set of co-ordinated activities to direct and control an organisation in order to continually improve the effectiveness and efficiency of its performance." These

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activities interact and are affected by being in the system, so the isolation and study of each one in detail will not necessarily lead to an understanding of the system as a whole. The main thrust of a QMS is in defining the processes, which will result in the production of quality products and services, rather than in detecting defective products or services after they have been produced.

Quality management is a true 20th century concept. In the past, a single person or small group would create a finished product from start to finish. Since the buyer often knew the producers of the product, items of poor quality were generally not sold. With the take-off of industrialized manufacturing, particularly involving interchangeable parts and assembly lines, quality became more of an issue. When a large group of people and machines create a good, the final product is a cumulative effort of all of their various jobs. If one person is not performing well, or using a substandard piece, the final good will be of poor quality.

Originally, a quality management system revolved around finished products and nothing else. At this time, the goods were checked to make sure there were no obvious defects or problems in the construction, and that was about it. Problems that arose after the goods were purchased were often attributed to the user rather than the product itself. While this mindset persisted for several years, more demanding consumers and increased competition gradually eroded this concept.

The first major change to the quality control system revolved around the long-term viability of the product. These ideas basically stated that a product needed to continue working as expected for a specific amount of time. If it failed before that, and there was no evidence of misuse, the product was considered faulty and the manufacturer was to blame. This idea was the precursor to the modern warranties common on most products today.

The second major innovation in the quality management system related to quality of service. Originally, these concepts only applied to goods and had nothing to do with customer interaction. As the quality management system matured, it began to apply to both marketing and direct interaction with customers, such as through tech support and sales. In these forms, a quality management system revolves around a workforce providing a basic level of competence, courtesy and truthfulness when interacting with customers.

Toyota's JIT Revolution: A Legendary Production System

In the mid-1990s, more than fifty executives and engineers from major automobile companies worldwide visited Toyota Motor Company's (Toyota) manufacturing complex at Georgetown, US, to study the Toyota Production System (TPS). The visit also included an intensive question and answer session. Even though the visitors were from competing automakers, including Ford and Chrysler, Toyota did not deny them access to the plant.

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> The TPS aimed to produce world-class, quality automobiles at competitive prices. It was built on two main principles, Just-in-Time (JIT) production and Jidoka.2 JIT was used not only in manufacturing but also in product development, supplier relations and distribution. Analysts remarked that despite imitating Toyota's JIT for many years, no other automaker in the world had been able to make their production systems and processes as efficient as Toyota had done. Analysts felt that though other leading automakers like Mercedes-Benz, Honda and DaimlerChrysler excelled in advanced engineering techniques, engine technology and styling, they did not match Toyota in efficiency, productivity and quality.
>
> Executives of rival companies also appreciated Toyota's manufacturing and product development systems. Officials at GM commented, "Toyota is the benchmark in manufacturing and product development." A top executive at Ford said, "Toyota is far ahead in developing markets that the real race is for the second place." Some executives at BMW also considered Toyota the best car company in the world.
>
> The early adoption of JIT principles by Toyota seemed to have helped the company achieve significant success. It helped the company respond quickly to changing customer needs and offer high quality products at low costs, thus increasing customer satisfaction.
>
> **Source:** *http://www.icmrindia.org*

4.1 UNIT OBJECTIVES

After going through this unit, you will be able to:

- State the difference between TQC (Total Quality Control) and TQM (Total Quality Management)
- Discuss the concept of TQC (Total Quality Control) in Japan, US and Europe
- Describe the elements of TQC (Total Quality Control)
- Discuss six sigma quality approach and process.

4.2 TOTAL QUALITY CONTROL SYSTEM VS. TOTAL QUALITY MANAGEMENT SYSTEM

Total Quality Control (TQC) System for optimizing production based on ideas developed by Japanese industries from the 1950s. The system, which blends western and eastern ideas, began with the concept of quality circles, in which groups of 10–20 workers were given responsibility for the quality of the products they produced. It gradually evolved into various techniques involving both workers and managers to maximize productivity and quality, including close monitoring of staff and excellent

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customer service. The concept of kaizen, the notion that improvement must involve all members of a company, is central to TQC.

Total Quality Control defined as an effective system for integrating the quality development, quality maintenance and quality improvement efforts of the various groups in an organization so as to enable production and service at the most economical level which allows for full customer satisfaction.

It may be classified as a ''management tool'' for many industries showing an outstanding improvement in product quality design and reduction in operating costs and losses.

Total Quality Management is defined as a continuous effort by the management as well as employees of a particular organization to ensure long term customer loyalty and customer satisfaction. Remember, one happy and satisfied customer brings ten new customers along with him whereas one disappointed individual will spread bad word of mouth and spoil several of your existing as well as potential customers. You need to give something extra to your customers to expect loyalty in return. Total quality management systems manage quality. They have a strong philosophical base that incorporates several important concepts of TQC systems. Management efforts are oriented towards the achievement of complete customer satisfaction. Here we find an organization-wide responsibility for quality. Time to install is three to five years. The evolution shows a culture change in the organization which achieves customer orientation through various stages of development that progress through a system oriented to an improvement oriented to a prevention oriented state.

The progress from quality control to quality assurance to total quality control to total quality management took almost a century of concerted efforts from quality gurus, such as, Walter Shewhart, W. Edwards Deming, Joseph Juran, Kaoru Ishikawa, Genichi Taguchi, Armand Feigenbaum, and Philip Crosby. The quality movement was initiated in Japan by Deming and Juran. It was later picked up by the Japanese who have made the quality movement a big success story. Around the 80s Japanese companies, on a continuous cycle of never-ending improvements, surpassed the West. They captured the markets with their consistent quality products and have now shifted their priorities onto satisfying customers with products having high quality at low price.

The following table states the differences between the TQC and TQM:

TQC (Total Quality Control)	TQM (Total Quality Management)
1. Emphasis is placed on the process and continuous process improvement. 2. Total participation is required. Employees are encouraged to generate ideas and implement them.	1. Emphasis is placed on the target and achieving the target as soon as possible. 2. The system is simple and straight forward.

3. It is flexible - processes and methods can be easily changed.	3. Information delivery is accurate.
4. The target is not absolute - good for a changing market.	4. The process is considered after the goal has been established.
5. Sometimes the end result is very different from the original target - employees tend to lose sight of the goal because they are too focused on the process.	5. Employees stop actively thinking of and implementing process improvement - they don`t want to risk making a mistake or creating delays.

4.3 TOTAL QUALITY CONTROL IN JAPAN, US AND EUROPE

The birth of total quality in the United States was in direct response to a quality revolution in Japan following World War II, as major Japanese manufacturers converted from producing military goods for internal use to producing civilian goods for trade.

At first, Japan had a widely held reputation for shoddy exports, and their goods were shunned by international markets. This led Japanese organizations to explore new ways of thinking about quality.

Deming, Juran, and Japan

The Japanese welcomed inputs from foreign companies and lecturers, including two American quality experts:

- W. Edwards Deming, who had become frustrated with American managers when most programs for statistical quality control were terminated once the war and government contracts came to an end.
- Joseph M. Juran, who predicted the quality of Japanese goods, would overtake the quality of goods produced in the United States by the mid-1970s because of Japan's revolutionary rate of quality improvement.

Japan's strategies represented the new "total quality" approach. Rather than relying purely on product inspection, Japanese manufacturers focused on improving all organizational processes through the people who used them. As a result, Japan was able to produce higher-quality exports at lower prices, benefiting consumers throughout the world.

American managers were generally unaware of this trend, assuming any competition from the Japanese would ultimately come in the form of price, not quality. In the meantime, Japanese manufacturers began increasing their share in American markets, causing widespread economic effects in the United States: Manufacturers began losing market share, organizations began shipping jobs overseas, and the

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economy suffered unfavorable trade balances. Overall, the impact on American business jolted the United States into action.

The American and European Response

At first, U.S. manufacturers held onto their assumption that Japanese success was price-related and thus responded to Japanese competition with strategies aimed at reducing domestic production costs and restricting imports. This, of course, did nothing to improve American competitiveness in quality.

As years passed, price competition declined while quality competition continued to increase. By the end of the 1970s, the American quality crisis reached major proportions, attracting attention from national legislators, administrators and the media. A 1980 NBC-TV News special report, "If Japan can, Why Can't We?" highlighted how Japan had captured the world auto and electronics markets. Finally, U.S. organizations began to listen.

The chief executive officers of major U.S. corporations stepped forward to provide personal leadership in the quality movement. The U.S. response, emphasizing not only statistics but approaches that embraced the entire organization, became known as Total Quality Management (TQM).

Several other quality initiatives followed. The ISO 9000 series of quality-management standards, for example, were published in 1987. The Baldrige National Quality Program and Malcolm Baldrige National Quality Award were established by the U.S. Congress the same year. American companies were at first slow to adopt the standards but eventually came on board.

The European Foundation for Quality Management (EFQM) said that TQM strategies are characterised by the following:

- The excellence of all managerial, operational and administrative processes.
- A culture of continuous improvement in all aspects of the business.
- An understanding that quality improvement results in cost advantages and better profit potential.
- The creation of more intensive relationships with customers and suppliers.
- The involvement of all personnel.
- Market-oriented organisational practices.

Total quality management was developed by a number of Japanese firms in the 1950s and 1960s. But it was built largely on the teachings of W. Edwards Deming and Joseph Juran, two Americans who had quietly developed the principles in the aftermath of the Second World War. With the help of books and articles such as David Garvin's 1983 description in Harvard Business Review of the way in which TQM and other techniques were putting Japanese companies ahead of their foreign competitors, the idea was later reclaimed by the United States and widely adopted by American business.

Europe, which has at times looked left out of this game of American-Japanese ping-pong, has also made occasional claims of total quality. Raymond Levy, chairman of Renault, a French car company, said in the early 1990s:

Quality is representative of a culture which we Europeans have no reason to let others monopolise. The Europe of Descartes; the Europe of the Age of Reason and the Enlightenment; the Europe of the industrial and technological revolution of the last two centuries holds within itself all the elements of method conveyed by the term "total quality".

4.4 ELEMENTS OF TOTAL QUALITY CONTROL (TQC)

Though many factors are essential to the success of a system project, the following elements or programs seem necessary to TQC implementation:

1. **Education and Training:** The first and foremost concern in QC (Quality Circles) activities is with the quality of "people." How to "build" quality into people has been the main focus of TQC. To achieve this, various training and education programs, were developed to instill the TQC way of thinking in all employees in order to spark "awareness."
2. **Participative Management:** A successful TQC program requires a company-wide promotion with an employee's participation. All employees from top management, managers, supervisors, and workers in functional departments such as R&D, product planning, design, preparation for production, purchasing, manufacturing, quality control, sales, and after services as well as financial, accounting, and personnel should be included. In order to encourage their employees to actively participate in problem solving, Japanese companies have long relied on QC circles and other innovations such as job rotation, job enrichment, and job enlargement.
3. **Employee Suggestion Programs:** A suggestion program is an integral part of the TQC system. Top management must implement a well-designed suggestion plan to assure that the TQC system is dynamic. Rewards and recognition must be given to employees and the number of suggestions must be regarded as an important criterion in evaluating the performance of managers. The following are the ideas which are typically acceptable for suggestion.
   - Improvements in operating methods.
   - Improvements in working environment.
   - Improvements in machines and process.
   - Improvements in jigs and tools.
   - Improvements in product quality.
   - Improvements in customer relations.

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- Improvements in safety.
- Savings in energy, materials, and other resources.
- Ideas for new product development.
- Others that lead to higher product and cost reduction.

4. **Cross-Functional Management:** Because quality problems vary from product to product and their responsibilities are with different departments, it is very hard to receive cooperation from other departments under many current functional organization structures. In Japan, the quality, cost, and delivery schedules are arranged as cross-functions and are headed by special committees that directly report to the CEO (Chief Executive Officer). Members of the TQC committee, for instance, consist of board members (managers and employees) from related functional departments with the QC or quality assurance (QA) department acting as secretariat. In addition, for the sake of receiving highest attention from departments, the cross-functional goals should be determined before the departmental goals.
5. **Quality Information Systems:** A system of data collection and evaluation is a vital part of the TQC program. Accurate and timely data on defects, field failures, and complaints must be quickly analyzed and feedback provided to related people and departments for possible action.
6. **Basic Statistical Methods:** All employees active in TQC activities are well-trained in how to effectively use basic statistical methods for problem solving. These methods include, but are not limited to the following:
   - Pareto diagrams.
   - Cause-and-effect diagrams.
   - Histograms.
   - Control charts.
   - Scatter diagrams.
   - Graphs.
   - Check sheets.
7. **Quality Cost Systems:** A good quality-cost program should be able to pinpoint the areas where the application of QC can have the greatest monetary impact. It should also provide a critical measure of the financial health of the QC system. As such, the program must cover the measurements and reporting of the costs incurred in ensuring product quality, reliability, and safety. It should also measure the costs incurred from the failure to do so.
8. **Quality System Audit:** System audits provide a mechanism to periodically review quality-related policies, to scan environmental opportunities and treats, to coordinate TQC activities, and to identify system weakness and improper practices for ultimate correction. In Japan, the quality audit is further exemplified by the Deming Prize contest and by the President's annual field audit.

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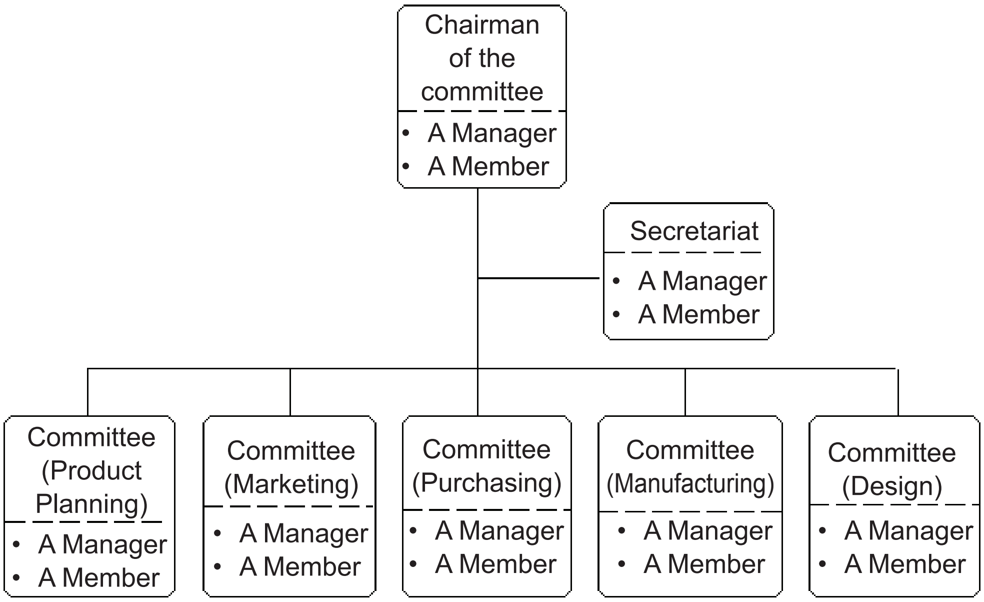


Fig. 4.1: An Organisation Chart for TQC

Caselet: Are You Quality Obsessed? 7 Steps To An Effective Quality System (Control Engineering)

Without a doubt, manufacturers today are under more pressure than ever to ensure the quality of their product, especially given the growing number of strict industry regulations. If the smallest part or ingredient is out of spec and a recall occurs, it is not only the manufacturer, but the entire supply chain, that is at fault. All it takes is one negative headline about a defective engine or a contaminated package of spinach to jeopardize a brand's reputation.

The companies that avoid negative press are the ones that truly embrace quality as a business function and recognize the value of an enterprise quality system. These manufacturers exert a tremendous amount of effort to secure their respective industry standards—whether Six Sigma, the Good Housekeeping Seal of Approval or positive reviews on CNET—and interestingly, all demonstrate the same habits when it comes to ensuring the quality of the products they produce.

By emulating the habits of these quality-obsessed manufacturers, you can make certain that a quality product runs through your facility and reaches the consumer, while making your entire manufacturing organization more effective along the way.

1. **Brag about your quality.** Customer satisfaction can make or break a manufacturer. Therefore, it is imperative to give upper management the data they need to build customers' confidence in your product. Sure, you can claim to produce a top-quality product, but sometimes your word is not good enough.

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Buyers want to see data that is meaningful to them, not just the required Cp (variation measurement) and Cpk (center tendency measurement). With a statistical process control (SPC) system, you can present upper management with data that quantifies quality in clear terms.

Most importantly, do not hide your data from the top brass; transparency is vital. To begin effectively bragging about quality, create a list of metrics and divide them into two groups – metrics that are impressive now, and metrics that, if improved, will help achieve higher organizational goals.

2. **Do what counts.** Now that you know the importance of data, keep in mind that more does not necessarily mean better. Data collected must have value, and should be concise. Consider the following when determining whether the data you are collecting is meaningful: If the data values significantly change, from the norm, during production, would the change lead to a corrective action? Also, if a corrective action is needed, is there a procedure in place to deal with it?

Prior to monitoring a process, make sure you have an effective sampling strategy and systems in place to take corrective action. Be sure to decide which employees are able to take action based on real-time data intelligence and provide them with the necessary reports to do their job the best way they can.

[Sidebar: How can you know who needs the data? In the case where data are already being collected and reported, be bold and challenge the status quo. At one large airframe manufacturer, a new manager wanted to find out who needed, or was even reading the numerous scheduled reports his department generated. He decided to stop all publications and wait for the phone to ring. He got all his answers in just a couple of weeks. Using the feedback from the few that contacted him, he completely revamped the reporting content and schedules.]

3. **Give the process a leading role.** True SPC involves three components: the process, the test characteristics being monitored, and the part being produced. When collecting data, the most important of these factors is the process, as it controls the consistency of the final product and influences manufacturing as a whole.

The process is needed to produce test characteristics, and test characteristics are needed to produce parts. Therefore, it is vital to include processes in your data collection and analysis – you will achieve new insights by monitoring even the seemingly smallest pieces of the process, such as which nozzle filled a particular container.

Remember, the machines (processes) in your plant that are most critical to quality, and make sure that you have a system that can measure their performance.

4. **Keep it simple.** With the right SPC software, capturing data should be a simple process. If data collection is difficult, an organization risks capturing inordinate amounts of meaningless data. Select an SPC platform that displays only what is helpful to the user. Visualizations, charts and even user-friendly spreadsheets are ideal. The software should also automate calculations and prompt users when specific quality checks are due. It's important to make sure that your shop floor systems are optimized for your shop floor environment so data can be accurately collected.
5. **Expect a value chain reaction.** Always remember, suppliers are an extension of your factory. The quality of the suppliers' products directly affects your final output.

For example, what happens if an automotive manufacturer unknowingly assembles a car with a supplier's defective transmission? With cloud-based SPC, manufacturers can extend quality throughout the supply chain—all the way down to the suppliers—so the faulty transmission, for instance, never even makes it to the production line.

The transparency provided by cloud-based SPC will ultimately increase profitability for both the supplier and the manufacturer by reducing scrap. If you are considering implementing a supply chain-wide, cloud-based SPC solution, begin by discussing the value of sharing real-time data with your customers and suppliers.

6. **Always be vigilant.** Control chart plot points will send one of two messages: Do something, or do nothing. As the "first life of a data point," both are equally important. When you see the 'do something' message, you should be able to decide on a course of action simply by comparing the data point with the previous plot point.

You must also understand the natural process variations so that you know when to avoid taking action. Don't tamper with the process if the signals are telling you to 'do nothing.' Make the control charts more meaningful by finding the earliest possible point to capture the data and be vigilant with responding to those messages.

7. **Always dig deeper.** What happens to all the real-time data you've collected? A process capability database houses the once real-time data. You can use this database to gain insight on how to improve processes in the future. Even the simplest data, such as lot numbers and raw material suppliers, can provide value and help you pinpoint their effects on a process' output.

Furthermore, the process capability database can make additional calculations that can lead to more accurate business decisions on a variety of levels, including make/buy, scheduling and raw material usage. You can improve your organization's ability to use data analysis to "predict the future" by identifying attributes that affect process outputs.

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These seven simple steps will increase your organization's understanding of the impact quality has on operational efficiency and the bottom line. Data are your greatest assets for gaining visibility into causes of quality issues and quick analysis often equals quick resolution. The correct approach to quality control yields benefits ranging from reduced scrap, rework and warranty claims to audit and recall management; from supplier benchmarks to customer satisfaction.

Perhaps more importantly, these seven steps lay the framework for making your company more data driven. By working smarter, you will eliminate the day-to-day headaches caused by fighting fires and replace them with a balanced, systematic approach to quality control.

Source: *http://www.infinityqs.com/articles/are-you-quality-obsessed-7-steps-effective-quality-system-control-engineering*

4.5 JUST-IN-TIME

Just-in-time manufacturing is a strategy used in the manufacturing industry to reduce costs by reducing the in-process inventory level. It is driven by a series of signals that tell the production line to make the next piece for the product and when it is needed. The signals used are usually simple visual signals, such as the absence or presence of a piece that is needed in the manufacturing process.

In just-in-time manufacturing, reorder levels for certain inventory items are set, and new stock is ordered only when those levels are reached. There is no overstocking of parts or items, which saves on space in the warehouse. This manufacturing strategy can lead to improvements in quality and efficiency. It also can lead to higher profits and a larger return on the company's investment.

Although this specific manufacturing strategy was created by the Toyota company in Japan during the 1970s, previous businesses used manufacturing processes that were based on similar concepts. One of the first was created by Henry Ford, whose automobile company bought materials only for its immediate needs in the manufacturing process. Ford bought only the amount of material that was needed in the plan of production and planned the transportation of materials so that the flow of the product would be smooth. This created a rapid turnover and decreased the amount of money that was tied up in raw materials.

Ford's manufacturing process was adopted by many other car manufacturers. Toyota used the process with satisfactory results and modified it to overcome some of its weaknesses, which led to what is now known as just-in-time manufacturing. The process allowed Toyota to reduce costs and build cars more quickly. Many vehicles were built to order, which reduced the threat that they would be built and not sold, thus eliminating a risk to the company.

Unlike some other types of manufacturing processes, with just-in-time manufacturing, assemblers do not have a choice of which parts to use; every part

has to fit correctly. This means that the use of multiple suppliers usually is avoided, and quality assurance is higher. The parts used are all of the same quality, which means that line stops for quality checks are almost eliminated, leading to higher productivity rates. Just-in-time manufacturing principles have been applied to many industries and businesses with successful results.

One potential flaw in just-in-time manufacturing is that it relies on an accurate anticipation of demand. Manufacturers need to gauge the levels of materials and parts that they need based on their previous or current sales figures. If there is a rise or fall in demand for the product, it could have serious effects on the just-in-time manufacturing process. Manufacturers have to make sure that they have a reliable sales forecast in place to allow for these fluctuations in sales, or they could have problems with inventory or with the manufacturing process.

4.5.1 Elements of JIT

The following are the key elements of JIT:

1. **Stabilized and uniform plant loading:** Create a uniform load on all work centers through constant daily, production and mixed model assembly (Produce roughly the same mix of products each day, using a repeating sequence if several products are produced. on the same line). Meet demand fluctuations through end-item inventory rather than through fluctuations in production level.
2. **Reduce set-up time:** Set-up time should be very less so that quick demands can be met. Aim for single digit set up time (less than 10 minutes) or "one touch" set-up time. This can be done through better planning, process redesign and product redesign.
3. **Reduce lot sizes:** Reducing set-up times allows economical production of smaller lots, close cooperation with suppliers is necessary to achieve reductions in order lot sizes for purchased items, since this will require more frequent deliveries.
4. **Preventive maintenance:** Use effective machines but the key is to use machine and worker idle time to maintain equipment and prevent break downs.
5. **Flexible work force:** Workers should be trained to operate several machines, to perform maintenance tasks, and to perform quality inspections. In general JIT requires teams of competent, empowered employees who have more responsibility for their own work. The Toyota production system concept of "respect for people" contributes to a good relationship between workers and management.

4.5.2 Features of JIT

The following are the key features of JIT:

- Numerous small machines: Inexpensive, adaptable, quick change over manufacture, variety of products.

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- Small batch production: Fast set-up times, reducing batch size, improves productivity.
- Employee flexibility: Staff to go to the work, staff move around the shopfloor. If break down occurs staff helps one another or move to other work.
- Employees responsible for production and maintenance—they do repairs also. Total preventive maintenance.
- JIT implies: no need of receiving inspection.
- Produce what is and not what may be required using kankan.
- Control inventory by improving capacity to respond to supply/demand function.
- Spare capacity: operate well below full capacity.

4.5.3 Equipment layout for JIT System

The layout in JIT manufacturing is often in the form of product focus and manufacturing cells. This type of layout is necessary because lot size production requires that the layout be compact and efficient to ensure smooth flow of materials. A pull production system requires close communication between work stations, unlike traditional manufacturing. The flow in a JIT system is in two directions, material is pulled forward, but information flows backward to provide feedback on material requirements. The various factors and parameters considered for layout of JIT system are

1. **Lot size:** In contrast to the traditional manufacturing, JIT manufacturing requires production of small lot sizes. Production of small lot sizes is made possible by drastically reducing set-up times. It is well documented that production of small lot sizes in JIT manufacturing is closely associated with improved quality, reduced inventory, easier delivery and other market responsiveness. With continuous flow of small lot-sizes of information, downstream team members can begin working on different phase of the design while final design is being developed. Continuous flow of information among team members reduces uncertainty and encourages early detection of problems, which enables organizations to avoid costly and time consuming changes.
2. **Employee and supplier involvement:** In a JIT system, management encourages employee involvement and team work. The responsibility for job scheduling is at the shopfloor. Due to production of small lot size, delegation of authority to the teams at the shopfloor is essential for smooth production flow. The responsibility for scheduling of the activities is often pushed down to the product development team at the lowest level. Passing responsibility down to teams is essential to achieve a high level of activity, coordination and information sharing among team members. In JIT suppliers also work closely with the organization to improve quality, shorten delivery time, and offer ideas towards new design.

3. **Quality:** Under JIT manufacturing organizations are often positive and quality means getting it right the first time. In JIT, since lot sizes and set-up time are small quality at source and continuous improvement are the main foundations. Down team workers are empowered to become their own inspectors responsible for the quality of their output.
4. **Technology:** In a JIT manufacturing system technology comes after simplification and understanding of the entire system and technology is not viewed as a shortcut to process improvement. Rather, technology has been utilized after process analysis and simplification has been performed. The key to the success of technology is building an effective design team with open cross-functional communication lines. JIT system requires that the design team with diverse expertise makes a large number of interrelated decisions regarding the form, fit function cost, quality, and other aspects of the design. This requires supply and processing of relevant information from multiple sources in a coordinated and logical manner. Effective use of technologies and tools can dramatically shorten set-up time, reduce the number of prototypes, cut costs and improve quality of the design.
5. **Just-in-time purchasing:** JIT is an approach with the objective of producing the right part in the right place at the right time. This obviously means that purchasing the raw material should also beat the right time or just in time.
6. **Just-in-time production:** JIT production is closely related to the practices of designing. Focused factories (The term focused factories refers to small specialized manufacturing plants that are dedicated to the production of a small number of products) and cellular manufacturing (It refers to the practice of organizing a factory into manufacturing cells that are dedicated to the production of a single product, or a few similar products). The advantages of arranging the production factories into various cells include obtaining more accurate product costs and less product diversity within a cell. However, ITT production also includes several other elements that are listed below.
   - A demand pulls system including kanban production control.
   - Emphasis on reducing set-up time and cycle time, i.e. time from start to finish.
   - Flexibility and short set-ups for the different products produced in cell.
   - A policy of stopping the production line to correct defects.
   - Small or zero inventory buffers.
   - Simplifying and dominating unnecessary resources and activities in addition to organizing production facilities into manufacturing cells.
7. **Fail proof devices and preventive manufacturing:** The equipment layout of a demand pull system (JIT system) aims at producing only what is needed by the next operation and only at the time it is needed. Producing more inventory than

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immediately needed is considered a form of waste. A kanban is a Japanese word meaning card. JIT production control is a manual system where kanban cards are used to authorize production and the movement of materials and products within the plant. The authorization kanban comes from demand downstream, thus inventory is pulled rather than pushed through the plant. JIT production also emphasizes continuously reducing the time required to perform the needed machine set-ups and operation, thus reducing down time and production lead time to a minimum correcting defects as they occur and emphasizing on small or zero inventories. Fail proof devices such as warning bells times electric eyes and alignment templates are also used to prevent from occurring.

4.6 STATISTICAL PROCESS CONTROL (SPC)

Process control is concerned with assuring that future output is acceptable. Since, the responsibility for output lies with the production department, the responsibility for achieving the appropriate quality in the transformation process must also lie with production and operations. Statistical process control methods, supported by management commitments and good organisation, provide objective methods of process quality control is any transformation process, whether this is in the manufacture of goods or the provision of service. Statistical process control techniques may be used to measure the degree of conformance of purchased materials, services, processes and products to previously agreed specifications. In essence statistical process control techniques select a representative, simple, random sample from the population, or the process input or output. From an analysis of the sample, it is possible to make decisions regarding the current performance of the processor, and its inputs or outputs.

Numerical information or quality will arise either from:

- Counting (or)
- Measurement

Data which arise from counting can only occur at definite points or in 'discrete' from. This data is also called attributes. Data which arise from measurement can occur anywhere at all on a continuous scale and are called variable data. The measurement of the variables produces continuous data.

Statistical Process Control (SPC) is an industry-standard methodology for measuring and controlling quality during the manufacturing process. Quality data in the form of product or process measurements are obtained in real-time during manufacturing. This data is then plotted on a graph with pre-determined control limits. Control limits are determined by the capability of the process, whereas specification limits are determined by the customer's needs.

Data that falls within the control limits indicates that everything is operating as expected. Any variation within the control limits is likely due to a common cause—

Check Your Progress

1. What do you mean by Total Quality Control System?
2. Define TQM.
3. State the meaning of JIT.

the natural variation that is expected as part of the process. If data falls outside of the control limits, this indicates that an assignable cause is likely the source of the product variation, and something within the process should be changed to fix the issue before defects occur.

With real-time SPC you can:

- Dramatically reduce variability and scrap
- Scientifically improve productivity
- Reduce costs
- Uncover hidden process personalities
- Instantly react to process changes
- Make real-time decisions on the shopfloor

Measuring the ROI of a Real-Time SPC Solution

To quantify the return on your SPC investment, start by identifying the main areas of waste and inefficiency at your facility. Common areas of waste include scrap, rework, over inspection, inefficient data collection, incapable machines and/or processes, paper-based quality systems and inefficient lines. You can start to quantify the value of an SPC solution by asking the following questions:

- Are your quality costs really known?
- Can current data be used to improve your processes, or is it just data for the sake of data?
- Are the right kinds of data being collected in the right areas?
- Are decisions being made based on true data?
- Can you easily determine the cause of quality issues?
- Do you know when to perform preventative maintenance on machines?
- Can you accurately predict yields and output results?

Case Study: Accellent Chooses InfinityQS as Quality Platform to Support Strategic Goals

Accellent, Inc. provides fully integrated outsourced manufacturing and engineering services to the medical device industry in the cardiology, endoscopy and orthopaedic markets. Accellent has broad capabilities in design & engineering services, precision component fabrication, finished device assembly and complete supply chain management. The company is focusing on "Continuous Improvement", which is supported by the strategic goal of delighting its customers through eliminating customer complaints. Continuous improvement also emphasizes improving processes to better serve customers by standardizing quality practices.

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In support of these key initiatives, Accellent has chosen to standardize on InfinityQS as the standard Statistical Process Control (SPC) platform, rolling out the system at some key facilities. On March 14, 2007, Accellent signed a corporate Licensing Agreement with InfinityQS, providing discounts on software and support, including training.

SPC helps to eliminate customer complaints by establishing expected limits around which a process functions. By doing this the system can identify significant events that affect a process and alert the operator. The operator can then adjust the process before the process produces a non-conforming part. This reduces the risk of shipping a non-conforming part to a customer, thus eliminating customer complaints.

Accellent chose InfinityQS because the software offers many advantages over other SPC packages available. One advantage that the company cited is the use of a Relational Database structure, which utilizes common databases such as Oracle. An integrated analysis packages through the enterprise edition includes tools for supporting lean six-sigma and continuous quality improvement. InfinityQS optionally integrates SPC, Measurement System Analysis (Gage R&R), and Gage Tracking and Calibration. This expands the capability to analyze the measurement system, as well as the process of manufacturing the parts. InfinityQS further allows engineers the ability to put "any data on any chart", enhancing the ability to measure and analyze processes for improvement opportunities.

A further advantage of InfinityQS is the configurable toolbar. The toolbar allows access to shared documents through the click of a button. This allows the operator one-click access to such documents as the prints, control plans, inspection records, and other quality-related documents. Todd Gatto, Senior Quality Engineer at the Wheeling facility said, "One of the main reasons we liked InfinityQS is that we can configure the toolbar to access our controlled documents through the project. Where we spent time clicking through multiple folders to find documents, now there is one button to open that document. It promises to be a real time-saver for the operators."

InfinityQS is designed to be run as a real-time shopfloor SPC system. Data is inputed manually or automatically. Data is then tracked and monitored through the use of one or more of the 300 available control charts. Alerts are generated automatically through the charts, e-mail, and other forms of communication. E-mail notification can be configured to be sent to individuals responsible for supporting the process. Because of the database structure, data may be entered on the shopfloor, and analyzed real-time remotely by support staff. Upland has been using the software for a number of years. According to Dody Dunquez, Quality Supervisor, "We've been using this software for 11 years and it is really user friendly for the floor user. Once you do a few [projects] it's second nature."

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The ability of InfinityQS to collect data has the added advantage of reducing cycle time in measuring parts as well, an advantage toward the strategic goal of reducing cycle time in everything Accellent does. “We began to implement InfinityQS in our inspection areas [Incoming and Final], and immediately saw the advantage of interfacing gages. Instead of measuring parts and spending time filling in an inspection record, the inspector is able to hit a button, the data is automatically entered and the inspection record is generated,” said Gatto.

Wheeling began to implement InfinityQS in their inspection areas as part of a focused effort to reduce cycle times in incoming and final inspection. They are also implementing in quality areas as part of a qualification effort. They expect to roll out InfinityQS to the shopfloor later this year to replace existing, out-dated SPC stations. Brooklyn Park has also rolled out InfinityQS in their VMC Department. According to Eric Sandberg, Quality Technician, “We also have been collecting data from a portion of our VMC department since September using inspection automation, which has reduced the source inspection times by about 80%.”

Source: *http://www.infinityqs.com/case-studies/accellent*

4.7 QUALITY CIRCLES

Quality circles are groups of individuals who come together for the purpose of evaluating a particular operation or procedure, determining how well that process is functioning, and seek to find ways to enhance that function. A quality circle may be used effectively in a business setting, or as part of the ongoing checks and balances within a non-profit organization. The members of the quality circle may be employed by the organization, be it students from a local educational institution, or be it consumers or supporters who have an interest in the goods or services offered by the organization.

In a business setting, a quality circle is normally a volunteer group of employees who focus on a specific aspect of the operation, such as a department. The group serves to not only evaluate the current quality of the products produced, but also how efficiently those products are created. A departmental supervisor who acts as the leader and facilitator for the group may lead the quality circle. It is not unusual for the circle to elect a team leader who functions as the liaison between the group and management.

A Quality Circle may be defined as a small group of between three and twelve people who do the same, or similar work voluntarily, meeting regularly for about one hour per week, in paid time, usually under the leadership of their own supervisor, to identify, analyse, and solve some of the problems in their work, presenting recommendations to management and where possible, implementing the solutions themselves.

The significant expressions in the above definition are:

- A small group of people who do similar work;
- Between three to twelve people;
- Voluntarily meeting together;
- Meeting regularly for about an hour per week;
- Meeting in paid time,
- Under the leadership of their own supervisor;
- Identify, analyse and solve problems in their work;
- Presenting solutions to management;
- Implementing the solutions themselves.

A Small Group

The circle should comprise a more or less homogeneous group of people usually from the same work area. They will usually have a similar educational background; use the same technical jargons and no one member should be inhibited in any way by the presence of another. There, may be exceptional circumstances wherein variations of this important requirement, may be acceptable, for example inviting specialists for a specific project when they need expert advice or guidance.

Between Three to Twelve People

The size of a Circle should be limited to ensure that the Circle is a team and not a committee. This team is precisely a Section's Circle and not an elite group in their work area. The size of the Circle has to be small to facilitate the participation of every member. Every member of the team should be encouraged to make suggestions and candidly express the ideas on Circle projects.

Voluntarily Meeting Together

This means that members are to attend and participate in the meetings of the Quality Circles out of their sweet violition, without any compulsion. People are free to join and free to leave. If a person joins the Circle and subsequently chooses to leave it, there should be no pressure, inquests, or recriminations. The person may be asked to express his/her reason for leaving. If there is a problem which could be sorted out amicably, the person may return to the group if he/she chooses.

Meeting Regularly

A regular meeting is habit forming, as the day of the meeting will soon be associated in the minds of the members as Circle Day; and so members are much less likely to forget to attend. The duration of the meeting should be flexible and proportionate to items to be discussed. Normally Circles do not keep minutes of meetings. They get down to work straight away. It has been known from experience that a great deal can be achieved in meetings lasting not more than an hour.

In Paid Time

The meetings are very much part of work assigned to a staff member of the organisation and hence has to be recognised as an official duty of the member. There is nothing extraneous to duty in this.

Leadership

As the Circle is concerned with purely work-related problems, the supervisor is the appropriate person to lead the group. However, once the group is formed, the members would soon realise that leadership could never be hindering any aspect of discussions. Decision making is a totally democratic process; no one’s opinion is any more or less important than anyone else’s.

Identify, Analyse and Solve Problems

The key point about this part of the definition is the fact that the Circles identify their own problems in their own work area. It is this aspect of Quality Circles that get their strength and the members the greatest satisfaction. They are not meeting to criticize the work of others irrespective of the linkages their work may have with the work of others. In fact, there are plenty of problems in their own work area which can be brought under their control wherein they can apply their own knowledge and experience to get results.

Presenting Solutions to Management

After collecting data, trying out new ideas and discussing them over a period of time, if the Circle is convinced of the value of their solutions for improvement of a particular aspect of work, it is necessary to present their ideas to their manager. It is a good practice that all members of the Circle participate in the presentation to the management. While there is no obligation on management to accept the ideas of a Circle, they must be given serious consideration. If management decides to turn down a proposal, it really owes it to the Circle to give explanation for its rejection. It appears that Circle projects are usually so carefully thought out and done, outright rejection by management is quite rare.

Implementing the Solutions

Identification of a problem and solutions thought out, having been done by Circles, they can themselves often implement them. This is particularly true of housekeeping problems, reduction of waste material, energy saving, doing their own jobs better and so forth

Organisation and Operation of Quality Circle

The essence of Quality Circles is to bring the self-control element to groups of people rather than individuals. The aim is to provide all the means by which employees

can control their own performance, both individually and in group-based activities. This concept goes far beyond simple problem-solving, although problem-solving is usually the point where they start.

As part of its responsibilities, a quality circle will identify and analyze each aspect of the area under scrutiny, making it a point to identify both the strengths and the weaknesses that the group members see with the current process. Doing so allows the circle to effectively brainstorm on potential changes or enhancements that would help to minimize or eliminate these weaknesses while not having any type of negative impact on those qualities identified as strengths. Generally, no aspect of the functions under consideration are exempt from investigation and evaluation, including management processes, selection of raw materials, or even the packing and storage of the finished products.

A quality circle can also be utilized effectively in other settings. Non-profit organizations may provide supporters the opportunity to come together on a regular basis to evaluate fund-raising or public awareness projects that are operated by the entity. At educational institutions, a quality circle may provide valuable insights and suggestions regarding the structuring of a degree program, the organization of a university department, or suggestions for possible future class electives. In any setting, the ultimate goal of the quality circle is to identify improvements that will aid the organization in continuing to grow and move closer to realizing its goals.

The use of a quality circle within an organization can often make it possible to identify little issues that are difficult to be seen otherwise. Drawing on the expertise of the members of the group makes it possible to not only identify issues that should be addressed, but also develop solutions for those issues. Often, this process allows circle members to increase their sense of belonging and investment in the business or institution, and feel they are making a positive contribution to the organization.

4.7.1 Genesis of Quality Circles

During his visit to Japan in the year 1950, Dr. E.W. Deming first introduced Japanese Industry to 'Statistical Quality Control (SQC)' techniques. Japanese industry realized that only sustained efforts to employ SQC techniques to manufacturing operations would pave the way for revival of Japanese economy, which was devastated during the second world war. In order to popularize SQC, the Japanese Government passed a legislation, which allowed the use of 'Engineering Standard' mark on products to those organizations, which practiced the specified SQC techniques in their operations.

In 1954, Japanese Union of Scientists and Engineers (JUSE), invited J.M. Juran, a world renowned expert in the field of quality, to talk on 'Quality Management'. Juran highlighted the need for looking at every function in the organization as a 'Quality Function', thus spreading quality across the entire organization. Japanese interpreted this concept even more broadly and felt the need for involvement of every individual in the organization in the quality improvement programs.

Dr. Korau Ishikawa, widely considered as the father of 'Quality Circles', saw the potential of significant contribution from the large work-force to quality, productivity and other work-related issues. In 1961, JUSE sponsored research work, which combined the theories of behavioral science to quality control concepts. Dr. Ishikawa led this research work. He formed the first Quality Circle in Nippon Telegraph and Cable Company in 1962. The concept caught on like wild fire and engulfed the entire Japanese industry within the next few years.

4.7.2 Basic concepts of quality circles

Quality circle is a company-wide activity based on following concepts:

- Obtain contribution of everyone to the improvement and development of the company.
- Develop respect for each other and build a congenial work place where people can enjoy their work.
- Give full scope for use and development of human capabilities, which can open infinite possibilities for improved performance of the organization.

Human relations related ideals of Quality Circles.

- Man is neither a mere commodity nor a liability but has potential to become an asset for the Company by making his life target to contribute to Company's progress.
- Every person must strive continuously to improve his work and develop his capabilities.
- Every person is unique and can contribute in his unique way.
- There is more pleasure in working as a group rather than as an individual (This concept is known as "WA" in Japan).
- Learning from each other can lead to the best and safe way to work.
- A cheerful work place, where people enjoy their work will ultimately reduce the defect rate and improve productivity.

4.7.3 Structure for Quality Circle Activity

1. Top Management.

- Visibly demonstrate its understanding, support and faith in Quality Circle activity.
- Provide adequate budget for QC activity.
- Institute an award system, which can motivate employees to voluntarily join the circles.
- Promote healthy competition between circles.

- Provide time-to-time inputs to eventually lead the activity towards self sustenance.
- Attend management presentations of Quality Circles.
- Respond to the suggestions/recommendations made by QCs in prompt and positive manner.
- Monitor the progress of the activity on a regular basis.
- Make QC activity review a mandatory point for the regular management reviews.

2. Steering Committee

This committee comprises of senior managers with executive powers and will have following functions to perform towards Quality Circle activity.

- Give full support to the activity in their respective areas.
- Develop working methodology and overall framework for QC activity.
- Establish program objectives and requirement of resources.
- Provide policy guidelines and directions.
- Nominate coordinator and facilitators.
- Attend management presentations of QCs.
- Obtain feedback from the facilitator and act on his recommendations.
- Decide on the rewards to QCs, based on their performance.
- Continuously monitor the QC activity.

3. Coordinator

Coordinator is a person appointed by the steering committee, who will coordinate the QC activity throughout the organization so that the activity runs in a smooth, effective and self-sustaining manner. He will have following functions to perform.

- Registering all the Quality Circles in the organization.
- Liasoning with facilitators for regular and timely meetings of the QCs and management presentations.
- Convening the steering committee meetings and circulate the minutes.
- Organizing all documentation and publication of QC cases.
- Giving all the assistance required by QCs.
- Publishing news letter on QC activity.
- Preparing training material and organizing training of facilitators and leaders
- Keeping track of QC activity outside the organization and disseminating the relevant information within the organization
- Creating awareness of QC activity at grass roots level in order to motivate employees at all levels to join the activity.
- Organizing conventions on QCs.

4. Facilitator

He is a senior officer of the department nominated by the Steering Committee to carry out following functions, which will help and consolidate the Quality Circle activities in his department.

- Attending the Quality Circle meetings at least for a brief time.
- Giving guidance to Circles for conducting the meetings as per laid down system and ensuring that proper records are maintained of each meeting.
- Arranging for the necessary training to Circle members with the help of the Coordinator.
- Providing the necessary facilities and resources to the Circles.
- Arranging for any external help required by the Circles.
- Resolving the problems faced by the Circles.
- Acting as a link between Circles and the Management.
- Collection and dissemination of information, publications, literature etc. related to Quality Circle activity.
- Arranging periodic get-togethers of the Circle members with participation of management personnel.
- Cultivating and promoting participative culture within his department.

5. Leader

Leader is a person chosen by the Circle members from amongst themselves. Leader can change by rotation. During the starting phase of a Circle, a supervisor can be the Leader but eventually, any member can be nominated as a Leader by the Circle members. Functions of the Leader are:

- Convening and conducting the Circle meetings as per the laid down schedule.
- Maintaining all the documentation related to the Circle activities.
- Arranging for the necessary training of the Circle members with the help of facilitator.
- Ensure involvement of every member.
- Setting goals and reviewing progress during each meeting.
- Drawing an action plan and delegating responsibilities to the Circle members.
- Encouraging a consensus approach in problem-solving.
- Get external help as and when required with the help of a facilitator.
- Prepare for management presentations.

6. Members

Members are the basic and most important element of Quality Circles. They are mostly drawn from the work area where the Quality Circle is formed and continue

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to be members of the Circle as long as they are the part of that work area. Their functions are:

- Be regular and punctual for the Quality Circle meetings.
- Get conversant with various statistical tools recommended for problem-solving.
- Identify problems in the work area and put these forth for consideration in the Circle meeting.
- Contribute ideas for problem-solving.
- Cooperate with other members and the leader to form a cohesive team.
- Take part in management presentations.

4.7.4 Implementation of Quality Circle Activity

Introduction of Quality Circle activity must be preceded by implementation of Total Quality Control (TQC), which is discussed in greater detail in a subsequent chapter. This will help in developing management attitudes and practices oriented towards quality of processes and creating a culture conducive to defect free operations. Creation of a 'flexible workforce' and implementation of Quality Circle activity can become complementary activities. Once a suitable atmosphere is created within the organization, following steps can be taken for implementation of Quality Circle activity.

- Discussions between different layers of organizational structure viz. Top Management – Departmental Heads, Departmental Heads – Sectional heads, Sectional Heads – Supervisors, Supervisors – Operators about the concept of Quality Circle and its relevance to the organization.
- Training programs for different levels to explain the basics of Quality Circles and the role each level is expected to play in the activity.
- Gathering the feedback from participants on their views and inhibitions.
- Clearing the doubts in everybody's minds and making them receptive to the concept.
- Form a Steering Committee to give overall direction to the effort.
- Select a coordinator and entrust him with the job of working out a methodology, which is suitable for the organization for starting the activity.
- Select the departments where the pilot Quality Circles can be started.
- Select the facilitator and leaders and train them to play their role effectively.
- Motivate the members to join voluntarily and train them for their role.
- Start the meetings of pilot Circles and closely follow their work.
- Arrange for the management presentations for the pilot Quality Circles and give wide publicity for their achievements.
- Extend the activity to few more departments.

- Keep on encouraging areas where the activity is not started by showing them the achievements of the working Quality Circles in other areas and the benefits and recognition they have received.

4.7.5 Management Presentation

This is the most vital part of the Quality Circle activity as it gives an opportunity to the Circle members to present the work they have done in identifying the problem in their work area and the systematic efforts they have put in to analyze the problem and find a solution for the same. As the Circle members get an opportunity to interact with the Top Management and get their approval for implementing the solution and also appreciation for their efforts, it acts as a strong motivating factor and helps in keeping the employee morale high. The presentations are done in a structured manner with the help of charts, graphs and using sophisticated audio/visual tools. Quality Circle activity cannot take roots and eventually sustain without the keen interest and continued support of the Top Management. Presence of Top Management at the management presentations is the visible indication of this interest and support.

4.7.6 Quality Circle Training

Training for Quality Circle activity covers the following aspects:

- Bringing in the awareness about "What is Quality Circle Activity?" and "How it can be beneficial to every participating individual as well as to the organization.?" This is necessary to overcome initial resistance to the new idea and prepare the employees to voluntarily accept the change.
- Prepare every person involved in the Quality Circle activity to play his role effectively.

People are to be trained for specific roles and the specific training to be given to each level is given below.

Training for Members

- Introduction to Quality Circle activity and its benefits to the individual and to the organization.
- Basic statistical quality control tools.
- Problem-solving tools e.g. 7-step breakthrough sequence.
- Brainstorming.
- Record keeping and reporting.
- Presentation skills.

Training for Leaders

- Quality Circle principles and its working.
- Effective communication.

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- Leadership.
- Motivation.
- Art of conducting meetings.
- Goal setting and follow-up.
- Collection, analysis and presentation of data.
- Making effective presentation.
- Team building.

Training for Facilitator

- Quality Circles – Its genesis, concept and philosophy.
- Roles of facilitator and leader.
- Group dynamics.
- Conflict resolution.
- Proactive management.
- Likely problems in Quality Circle activity and their solutions.

Training for Coordinator and Top Management

- Role of Top Management in Quality Circle activity.
- Empowering people.
- Appraisal and reward systems.

4.8 QUALITY TEAMS

A team can be defined as a group of individuals working in harmony to achieve a common objective which as individuals they could not have been able to achieve. Teamwork is one of the underlying principles of total quality. In all spheres of activity the cooperation and shared understanding of a group of people with a common objective will usually achieve more than a single individual. This is very true in the case of TQM implementation. A team-based approach to quality improvement will create both – a greater sense of purpose and mutual dependence. Many organizations in India such as Maruti Udyog, Hero Honda, TVS Suzuki, Larsen & Toubro, Swaraj Mazda, etc. who are implementing TQM have formed various type of teams to meet their objectives.

In order to establish a team-based quality culture, high order team building skills must be issued by managers. Professor John Adair (1983) in his Action Centered Theory of Leadership has propounded a model which will apply very aptly in developing a team-based approach to TQM implementation. According to Adair, effective leadership rests on three promises (i) task, (ii) team and (iii) individual as shown in Fig. 4.2.

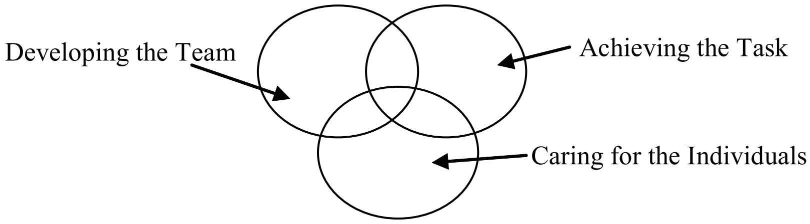


Fig. 4.2: John Adair's Action Centered Leadership Model

Thus, a manager responsible for team building in an organisation must be aware of Adair's leadership model. Managers should bear the following points in mind while building teams for TQM implementation:

- The objectives of the team should be agreed upon and clearly stated.
- The approach to achieving a task should be based upon effective team work.
- The leader of each team should be sensitive to the individual needs of each team member.

4.8.1 Features of Quality Team

Team objectives should be clearly established and should have the following features:

- Objectives should be agreed upon by the whole team.
- Objectives should be written clearly and unambiguously so that everyone understands the team's purpose in clear terms.
- Objectives should be directed to measureable results so that a team has a measure for success.
- In order to keep the team members motivated and in the right spirit, challenging but achievable objectives should be established on a scientific and realistic basis.
- Objectives should be arranged in a sequential and hierarchical manner
- Objectives should be quantifiable.

4.8.2 Role of Team Members

Teams are usually selected or authorized by the quality council. A team will consist of a team leader, facilitator, recorder, time keeper and members. All team members have clearly defined roles and responsibilities.

Team Leader

The team leader, who is selected by the quality council, sponsor or the team itself, has following roles.

- Ensures the smooth and effective operation of the team, handling and assigning record keeping, orchestrating activities, and overseeing preparation of reports and presentation.

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- Facilitate the team process, ensure that all members participate during the meetings, prevents other members from dominating, actively participates when appropriate, guides without being domineering, and uses positive interpersonal behavior.
- Serves as a contact point between the team and the sponsor or quality council.
- Orchestrates the implementation of the changes recommended by the team within organizational constraints and team boundaries.
- Monitor the accomplishments of members, assuring timely completion of assignments.
- Prepare the meeting agenda, including time, date, and location; and ensures that necessary resources are available for the meeting.
- Ensures that team decisions are made by consensus where appropriate, rather than by unilateral decision, hand-clasp decision, majority-rule decision, or minority-rule decision.

The Facilitator

The facilitator is not a member of the team; his/her neutral assistant and may not be needed with a mature team. This person does not get involved in the meeting content or evaluations of the team's idea. Roles are as follows.

- Support the leader in the facilitating the team during the initial stages of the team.
- Focuses on the team process; is concerned more with how decisions are made rather than the decision itself.
- Acts as resources to the team by intervening when necessary to keep the team on track.
- Does not perform activities that the team can do.
- Provides feed-back to the team concerning the effectiveness of the team process.

Team Recorder

The team recorder, who is selected by the leader or by the team and may be rotated on a periodic basis, has the following roles.

- Documents the main ideas of the main team's discussion, the issues raised, decisions made, action item and future agenda items.
- Present the documents for the team to review during the meeting and distribute them as minutes after the meeting in a timely manner.
- Participate as a team member

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The Timekeeper

The timekeeper, who is selected by the leader or by the team and may be rotated on a periodic basic, has the following roles.

- Monitor the time to ensure that the team maintains the schedule as determined by the agenda.
- Participate as a team member.

Team Member

The team member, who is selected by the team leader, sponsor, or quality council or is a member of a natural work team, has the following responsibilities.

- Contributes best, without reservation, by actively participating in meetings and sharing knowledge, expertise, ideas, and information.
- Respects other people's contribution, does not criticize, complain, or condemn.
- Listens carefully and asks questions.
- Is enthusiastic-it's contagious and helps galvanize the entire team.
- Works for consensus on decisions and is prepared to negotiate important points.
- Supports the decision of the team—badmouthing a decision or a member reduces the effectiveness of the team.
- Trusts, supports and has genuine concern for other team members.
- Understands and is committed to team objectives.
- Respects and is tolerant of individual differences.
- Encourage feedback on own behavior.
- Acknowledges and works through conflict openly.
- Carries out assignments between meetings such as collecting data, observing processes, charting data, and writing reports.
- Gives honest, sincere appreciation.

Other individuals will be active team members. However, some role has to be played by each team member. Some roles can be combined into one individual. But no one particular role should predominate; otherwise, the team will not work in a successful manner. If the management finds that there is an imbalance in team roles, then the composition of the team can be changed to instill the necessary stimulation for its success.

4.8.3 Ideal Team Size

Generally, as regards the size of the team, five to eight people form an ideal number to maximum individual contributions. Team size should not exceed eight persons because interaction and role playing becomes less in a larger team. Teams with

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less than five persons usually lack the combination of talents and ideas that a well balanced group can produce. Moreover, discussions within very small groups can prove arid and fruitless and result in little or no progress in the team activities. The managers must communicate within the organisation that everyone will be involved in the team-based activities so that persons in ‘a department or organisation may not carry an impression that the team is a group of a “chosen few”. The manager of the team-based organisation must keep all the other departmental members informed of the team’s progress. This will help in avoiding the feeling of a lineation by those who are not involved in team activities. This should ensure more ready acceptance of team’s recommendations.

4.8 4 Sigma Quality Approach and Process

Six sigma at many organizations simply means a measure of quality that strives for near perfection. Six sigma is a disciplined, data-driven approach and methodology for eliminating defects (driving toward six standard deviations between the mean and the nearest specification limit) in any process – from manufacturing to transactional and from product to service.

In theory, a six sigma would be approximately 2 failures per billion attempts. In practice, due to a drift of plus or minus 1.5, this status actually means fewer than 3.4 failures per million. This is an extremely low rate of failure, but has been proven possible in industry after industry over the past 20 years.

Bob Galvin of Motorola was a trailblazer in the adoption of six sigma by Motorola and other companies. His insistence on high levels of quality control, and subsequent vindication as Motorola achieved these levels, led to the spread of the system throughout the manufacturing world. The system’s tenets have since been successfully applied in many other areas of business, including customer service, transactional businesses, and the service industries.

The term failure is defined within each industry and product line, and simply means a defect that customers consider critical. Six sigma attempts to reduce these defects to a level below 3.4 failures per million.

There are two main methodologies in six sigma. The first is the DMAIC process: define, measure, analyze, improve, control. The second is the DMADV process: define, measure, analyze, design, verify. DMAIC is used for processes already in place which do not meet the system’s specifications, to help bring them within the threshold. DMADV is used for the development of new products or processes, to ensure that they meet the world at six sigma levels of quality.

There are three main certification levels of six sigma mastery: green belts, black belts, and master black belts. To achieve each ranking, a person must undergo extensive training in the system’s techniques and methodologies, then pass a certification test. According to some research, black belts save companies an average of $200,000 to $300,000 US Dollars (USD) per project and are able to complete up to six projects per year.

General Electric is the poster-child of the six sigma movement, with estimated savings of over $10 billion USD within the first five years of implementation since 1995. Their dedication towards reducing variation on each and every transaction since implementation has led not only to increased profits, but also to an improved public image and customer relations.

Six sigma values are straight forward and incredibly useful for businesses of all sizes. By focusing relentlessly on quality and the reduction in variations of product consistency, the system promises a better business.

How Six Sigma Solves Problems

The six sigma methodology for solving problems is similar to many other approaches. The differences arise mostly from six sigma's emphasis on statistical techniques to isolate and quantify undesirable variations in process and product performance. The mathematical techniques and analysis are central to six sigma steps for problem solving. The general steps one would follow with six sigma are:

- Identify a process or product variation that is creating undesirable performance results.
- Define the scope and parameters of the problem.
- Develop and apply initial measures of process or product variability.
- Estimate the business performance impact.
- Prioritize the project with other six sigma projects to establish when analysis begins.
- Collect and organize the data needed to carry out a thorough analysis.
- Analyze the data to pinpoint the cause or causes of variation.
- Develop an action plan for improving the process or product and a time-frame for full implementation of the action plan.
- Implement the improvements.
- Establish the control and feedback mechanisms for continuous improvement of the process or product.

Six sigma dovetails nicely with performance improvement initiatives intended to transform a traditional manufacturing company into a lean supply chain operation. An effective six sigma program can help to improve customer response time, cut cycle times, and improve product quality in engineering and performance.

These improvements appear not just in a narrow "reduction of defects" but can also generate revenue based on improved customer satisfaction. Customer satisfaction improves not because goods are more reliable and have fewer defects but because the entire process that the customer experiences from start to finish, from the sales office all the way through delivery and post-sale servicing and technical support, is improved. In addition, companies that implement six sigma programs can get additional benefits just by advertising their commitment to six sigma, as many have

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done, thereby raising the company's public profile. There is one important caveat, however: Six sigma's heavy reliance on mathematical and statistical techniques for determining process as well as product performance intimidates many managers, making it harder to sell as an approach to key people within the organization. Six sigma has its advocates, but it also has its detractors.

Resistance to six sigma arises sometimes because managers see six sigma advocates as "blind zealots" wedded to a single performance improvement philosophy. Companies that are considering implementing a six sigma program should be prepared to understand and cope with such resistance.

Process of Six Sigma Quality

The six sigma process is a business model or philosophy that aims to continue the enhancement of a product based on customer standards. This approach also focuses on quality improvement through checking products or services for the prevention of flaws. This model also emphasizes the implementation of company-wide activities in order to motivate the designated employees and teams for a higher performance. These teams will be monitored and hence motivated consistently into trying to measure up to the standards of quality set by the target customers and also to making sure that there is minimal deviation from the standards and requirements that were originally designed for the particular product or service to be marketed.

The six sigma process proves to be very beneficial when it comes to making sure that quality in products is achieved at a faster rate and that customer satisfaction is maintained. This is achieved through constant motivation of teams and employees in maintaining the good performance required of measuring up to the target customers' standards and expectations. This then leads to higher viability and profitability for the company that chooses the six sigma approach to quality improvement.

A quality improvement model that is used under the six sigma approach is one that has been credited to WE Deming. This quality management model is called DMAIC (Define, Measure, Analyze, Improve, and Control).

- **Define:** This first step in dealing with a product or service involves defining or determining the problem or cause for the flaw in quality. It also means determining the resources available (such as time, costs, manpower, etc.) that will enable for proper treatment of the problem. This step can also be roughly compared to "diagnosing the problem". Being able also to determine the scope of the development plan to be undertaken is part of this first process.
- **Measure:** This step entails determining the point of reference or yardstick for the measures to be done for the development plan to be undertaken. It is important to specify the rate of the defect that has been discovered as well as all other significant information that can be used in order to formulate the solution for the development plan to be implemented against the flaw that has

been discovered. Measuring is gathering the initial information necessary for formulating a solution.

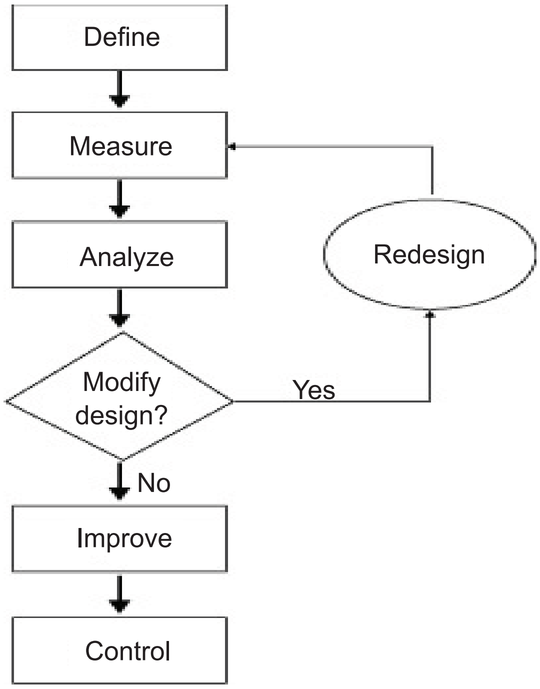


Fig. 4.3: The DMAIC Process

- **Analyze:** This step is now the "formulation of the solution". This means having had the necessary initial information on the problem or flaw, this step now entails the need for being able to make a plan or solution that will address the flaw that has been discovered, and then putting this solution to the test. There does not need to be only one solution however, the practitioner can implement experiments on certain samples in order to determine which the best solution is. Another function of this step is also to eliminate all the other selections and to then determine accurately the solution that will work best. This step can also be roughly compared to "formulating a hypothesis".
- **Improve:** This step now means putting into action the solution that has been formulated. This means actually putting the development plan into real application and evaluating whether it truly works to solve the discovered defect or not. More trial-and-error experimentation may be needed in order for this step to truly be effective in determining the best way to solve the problem.
- **Control:** This step is a defining feature of the DMAIC approach to six sigma. This step aims in making sure that progress remains on an uphill climb and not downhill. The usual assumption with quality improvement plans (and with most other business plans in general) is that the optimum performance can only be achieved at the beginning and that as time goes on, the performance lags and must then be replaced by a new development or business plan. The control step

ensures that this will not be the case as steps and methods for making sure that development is continuous will be implemented.

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While DMAIC applies to existing processes, a different six sigma method helps creates new processes or designs. It's called DMADV, which stands for Define, Measure, Analyze, Design, and Verify. Both DMAIC and DMADV were inspired by the late W. Edwards Deming, Ph.D., a U.S. statistician, teacher and consultant who helped develop modern quality control. Deming's Plan-Do-Check-Act Cycle, also known as the Deming or Shewhart cycle, laid the groundwork for DMAIC as a statistical and scientific method of business process improvement.

Numerous well-established quality management methods and statistical tools are used within DMAIC to drive process improvements. Many of these have been integrated into Six Sigma software packages to simplify the process. Most of these methods can be broken down into two categories: process optimization tools that help teams create more efficient workflows and statistical analysis tools that help teams evaluate data more effectively. Despite various criticisms of DMAIC, including its lack of originality and the controversial creation of a cottage industry for six sigma consultants, it continues to make a huge impact on how industries achieve and sustain operational excellence.

Case Study of General Electric: Six Sigma Implementation

General Electric, one of the most successful companies implementing six sigma, has estimated benefits on the order of $10 billion during the first five years of implementation. GE first began six sigma in 1995 after Motorola and Allied Signal blazed the six sigma trail. Since then, thousands of companies around the world have discovered the far reaching benefits of six sigma, including Japan's Taiichi Ohno used as a model for the Toyota Production System (TPS), did not let him down during bad economic times.

Motorola coined the term "six sigma" and created the original formulas in the 1980s. "The result was a culture of quality that permeated throughout Motorola and led to a period of unprecedented growth and sales. The crowning achievement was being recognized with the Malcolm Baldrige National Quality Award."

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Motorola factory that manufactured television sets in the United States was taken over by Japanese management. Under Japanese management, the factory was soon producing TV sets with 1/20th the number of defects they had produced under Motorola management. In 80s the company responded to the competitive pressure by engaging in a publicity campaign decrying "unfair" competition and calling for political protection solutions. Finally, even Motorola's own executives had to admit "our quality stinks," and Motorola decided to take quality seriously. Motorola's CEO at the time, Bob Galvin, started the company on the quality path and became a business icon largely as a result of what he accomplished in quality at Motorola.

Motorola concentrates on several key operational initiatives. At the top of the list is "Six Sigma Quality," a statistical measure of variation from a desired result. In concrete terms, six sigma translates into a target of no more than 3.4 defects per million products, customer services included. At the manufacturing end, this requires "vigorous designs" that accommodate reasonable variation in component parts while providing consistently uniform final products. Motorola employees record the defects found in every function of the business, and statistical technologies are made a part of each and every employee's job. Reducing the "total cycle time" from when a Motorola customer places an order until it is delivered is a vital part of the company's competitive advantage. Furthermore, as the result of these efforts, Motorola can now perform such feats as producing pagers, cell phones in lots ranging from one unit to 100,000. Through mass customization the factory can fill a precise order within minutes of receiving it. Thanks in large part to its six sigma activities, the company dominates such key high-tech industries as pagers, cell phones, and mobile communications, and is a significant force in many others.

Today, net profit is no more the only objectives or goals that global manufacturers are aiming for. There are many aspects to consider surviving, sustaining, or competing in the current turbulent global marketplace such as capturing more market share, establishing branding in market, acquiring weak competitors, developing Research & Development. In addition, many world-class manufacturers undertake continuous quality improvement initiatives to meet fast growing business's challenges to improve operational efficiency and to drive quality across the enterprise. In GE, "Quality" is not only a strategy to be competitive in the global market but also an opportunity to bring the company far ahead compared to their competitors. Globalization and instant access to information, products, and services have changed the way customers conduct business. Old business's models such, as loyalty is no longer applicable. Today's competitive environment leaves no room for error. Companies such as GE must delight their customers and relentlessly look for new ways to exceed the customers' expectations. This is why six sigma Quality has become a part of GE's culture. "Jack Welch describes six sigma as "the most challenging and

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potentially rewarding initiative we have ever undertaken at General Electric". The GE 1998 annual report states: "more than three quarters of a billion dollars in savings beyond our investment (in six sigma quality) with a billion and a half in sight for 1999. Moreover, in GE, it has been estimated that 20 to 25 percent of the overall cost of goods sold in the United States is spent on finding and correcting errors. Quality management programs today are, therefore, viewed by many companies as productivity improvement programs.

The traditional view of quality control was that it cost more to get higher product quality. But this is no longer the prevalent view. Japanese manufacturers are credited with popularizing the notion that quality drives the productivity machine. This means that if production does it right the first time and produces products and services that are defect free, waste is eliminated and costs are reduced. In this new way of thinking, when operation managers work to eliminate defects, the quality of products and services is improved and at the same time productivity also improves. Costs are reduced as product quality improves because there are fewer products lost to scrap, fewer products returned for warranty work, and fewer interruptions to production.

Jidoka was introduced in the early 1950s by Taiichi Ohno (Toyota Motor Company); Jidoka is based on the philosophy that all individuals should be personally responsible for the quality of the products they make. In the line process of Toyota, Jidoka pushbutton was introduced and all employees are authorized to stop the line by pressing one of these devices. Such action is taken for reason of quality, safety or pace of the line. With the process at a stand still, all attention is placed in correcting the fault, until the problem is solved, all production is stopped. Similar responsibilities are typically an integral part of people's roles in many Japanese firms. Here, the making and evaluation of products are clearly and firmly the responsibility of the same person.

The reason why do companies decide to emphasize on quality program could be much easier to justify because there are researches which have proven that costs are much cheaper than cost of quality. For example, cost of poor process such as internal failure cost results from defects that are discovered during the production of a service or product. They fall into two main categories: rework costs, which are incurred if some aspect of service must be performed again or if a defective item must be re-routed to some previous operation(s) to correct the defect and yield losses, which are incurred if a defective item must be scrapped. For example, an analysis of the viability of acquiring a company might be sent back to the mergers and acquisitions department if an assessment of the company's history of environmental compliance is missing. Likewise, if the inspector at the automobile paint shop discovers that the paint on the car has poor finish; the car may have to be completely re-painted. The additional time spent correcting such a mistake results in lower productivity for the sanding and painting departments. In addition, the car may not be finished by the date on which the customer is

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expecting it. Moreover, organizations can sometimes get too involved in "how to count defects" and report defect rates that they lose sight of the real value of six sigma, orchestrating process improvement and re-engineering (and bottom-line benefits) through the wise implementation of statistical techniques. If an organization does not apply six sigma techniques wisely, it will fail. By when this occurs there is the tendency to believe that the statistical techniques are not useful, when in fact the real problem is how the program was implemented and / or how the techniques were not effectively applied.

A good six sigma business strategy involves the measurement of how well business processes meet their objectives and offers strategies to make needed improvements. The application of the techniques to all functions results in a very high level of quality at reduced costs with a reduction in cycle time, resulting in improved profitability and a competitive advantage. It needs to be emphasized that organizations do not need to use all the measurement units that might be associated with six sigma. It is most important to choose the best set of measurements for their situation and focus their emphasis on the wise integration of statistical and other improvement tools.

Source: *http://www.mbaknol.com/management-case-studies/case-study-of-general-electric-six-sigma-implementation/*

4.9 SUMMARY

- Quality systems and their procedures complement an organization and drive the company forward. Through implementation in the form of quality programs, a quality system mobilizes and energizes an organization and its people.
- Total Quality Control (TQC), system for optimizing production based on ideas developed by Japanese industries from the 1950s.
- Total Quality Control defined as an effective system for integrating the quality development, quality maintenance and quality improvement efforts of the various groups in an organization so as to enable production and service at the most economical level which allow for full customer satisfaction.
- Total Quality management is defined as a continuous effort by the management as well as employees of a particular organization to ensure long term customer loyalty and customer satisfaction.
- The birth of total quality in the United States was in direct response to a quality revolution in Japan following World War II, as major Japanese manufacturers converted from producing military goods for internal use to producing civilian goods for trade.
- Just-in-time manufacturing is a strategy used in the manufacturing industry to reduce costs by reducing the in-process inventory level.

Check Your Progress

Fill in the Blanks

4. A …………… may be used effectively in a business setting, or as part of the ongoing checks and balances within a non-profit organization.
5. A ………….. can be defined as a group of individuals working in harmony to achieve a common objective which as individuals they could not have been able to achieve.
6. ………….. is a disciplined, data-driven approach and methodology for eliminating defects (driving toward six standard deviations between the mean and the nearest specification limit) in any process – from manufacturing to transactional and from product to service.
7. Deming's ………..., also known as the Deming or Shewhart cycle, laid the groundwork for DMAIC as a statistical and scientific method of business process improvement.

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- Statistical process control techniques may be used to measure the degree of conformance of purchased materials, services, processes and products to previously agreed specifications.
- Quality circles are groups of individuals who come together for the purpose of evaluating a particular operation or procedure, determining how well that process is functioning, and seek to find ways to enhance that function.
- A team can be defined as a group of individuals working in harmony to achieve a common objective which as individuals they could not have been able to achieve. Teamwork is one of the underlying principles of total quality.

4.10 KEY TERMS

- **Total Quality Control:** Total Quality Control defined as an effective system for integrating the quality development, quality maintenance and quality improvement efforts of the various groups in an organization so as to enable production and service at the most economical level which allow for full customer satisfaction.
- **Total Quality Management:** Total Quality Management is defined as a continuous effort by the management as well as employees of a particular organization to ensure long term customer loyalty and customer satisfaction.
- **Just-in-time:** Just-in-time manufacturing is a strategy used in the manufacturing industry to reduce costs by reducing the in-process inventory level.
- **Quality Circles:** Quality circles are groups of individuals who come together for the purpose of evaluating a particular operation or procedure, determining how well that process is functioning, and seek to find ways to enhance that function.
- **Team:** A team can be defined as a group of individuals working in harmony to achieve a common objective which as individuals they could not have been able to achieve.

4.11 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Total Quality Control defined as an effective system for integrating the quality development, quality maintenance and quality improvement efforts of the various groups in an organization so as to enable production and service at the most economical level which allows for full customer satisfaction.
2. Total Quality Management is defined as a continuous effort by the management as well as employees of a particular organization to ensure long term customer loyalty and customer satisfaction.

3. Just-in-time manufacturing is a strategy used in the manufacturing industry to reduce costs by reducing the in-process inventory level.
4. Quality circle.
5. Team.
6. Six Sigma.
7. Plan-Do-Check-Act Cycle.

4.12 QUESTIONS AND EXERCISES

Short Answer Questions

1. Define total quality control.
2. State the key differences between Total Quality Control and Total Quality Management.
3. What do you mean by participative management?
4. What is an employee suggestion programme?
5. State the meaning of cross functional management.
6. What are the key elements of JIT?
7. Define statistical process control.
8. What are the key features of quality teams?

Long Answer Questions

1. Discuss the concept of quality system. What are the key differences between TQC and TQM?
2. Discuss the emergence of TQC in Japan, US and Europe.
3. What are the key elements of Total Quality Control (TQC)?
4. Define JIT. What are the key elements and features of JIT?
5. Discuss the concept of quality circles.
6. Discuss the meaning and importance of quality teams.
7. Describe the six sigma quality approach and its process.

UNIT 5 TOTAL QUALITY MANAGEMENT SYSTEM

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Structure

5.0 INTRODUCTION

Total Quality Management (TQM) is a management philosophy that seeks to guide the operation of the entire organization. It typically requires every person in the organization to be focused on the customer and the service or product that the customer receives. Therefore, total quality management is typically integrated into all elements of the company and requires complete support from management and staff to be successful.

The basic principles of total quality management require all members of the organization to be focused on improving quality. Improving quality usually results in changing how employees are trained and how they produce their products or provide their services. For any change to be effective, it usually requires the total support of workers, which can result in improving the organizational culture. The

organizational culture consists of the attitude and beliefs of the workers throughout the company.

While many managers may believe that their organizational culture is positive, negative subcultures may prevent positive outcomes from occurring. Negative thinking is often the result of fear. Therefore, organizational leaders typically need to address the issues that impact these subcultures and motivate workers to embrace new management practices. This usually means eliminating fears that may exist within the workforce. Once workers are willing to support the organization fully, then total quality management practices can be implemented and customer satisfaction improved.

Mission and vision of an organization typically guide the operation of the business in total quality management. The operation is a process that is created based on data collection that requires consistent monitoring in order to identify problems and continually make changes. Typically, changes can only be made when the facts support them and those changes must work to support the strategic operating plan of the company. The operating plan usually needs to be aligned with customer need.

In total quality management, employees become part of teams that are tasked with completing a mission. Each team member is empowered in the organization because the team's action has the ability to result in the success or failure of the entire company. Teams typically require strong leaders that effectively communicate with fellow workers so that all employees understand the process of which they are a part. Leaders usually train, inspire pride in employees, and build confidence among workers so that they can assist in the success of the company and provide better customer services.

Total quality management also requires a fast response time in relation to consumer need. Managers not only concentrate on how their company operates, but also on the qualities of other companies in the industry that result in superiority. One of these qualities is often the ability of the company to immediately address a customer's concerns and produce a product when it is needed without an extensive wait time. When customers are required to wait for a product or service, they will often turn to a competing business for faster results. Consequently, total quality management calls on workers, managers, and leaders to develop operational methods regarding response time that focuses on customer satisfaction.

Case Study of Toyota: International Entry Strategies

Toyota is being known world-wide and being accepted as the world's most popular car manufacturer. Wherever we go, not even a single soul did not know what a Toyota is. This is what we called as Toyotaism. But, to accomplish this was not that easy compared to how it sounds. Toyota had to face several issues and problems also had taken multiple actions to solve them. Hiroshi Okuda had identified 3 issues relating to the management of Toyota. Those management

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issues are; (1) Lag in product planning, (2) Declining market share in Japan, and (3) was behind in overseas expansion. Due to these main issues, Toyota had taken several steps for the manufacturer to survive in its own name in its own country and also to the world outside.

TOYOTA

For Toyota to its brand visible, a number of development strategies had been taken by Toyota.

The first stage of Toyota's development strategy is Cross-Nation Space Strategy. It is where Toyota implemented a strategy of marketing its product in Japan and in other nations around the world. It is a strategy of blanketing the nations with all of Toyota's products. Manufacturing of products for Toyota started in 1938 where its first plant was built which is the Honsha Plant. It is after 20 years of incorporating that Toyota could construct their second plant which was in the year 1959. Upon incorporating, there were three major strategies being taken to ensure their success. First and foremost was to have high quality auto suppliers. Second, was for Toyota to built affiliates like providing housing and entertainment facilities for its own employees and families. This was because Toyota is making its employees and families as their crucial factors of Toyota's success. And thirdly was webbing Toyota dealers in which they developed on their channel of distribution.

It was up until 1960s that Toyota adopted nation-specific strategies to provide their automobiles throughout the nations. Due to that, Toyota Motor Sales (TMS) had set up an export department for the main reason to pioneer the overseas market. First exporting activities being done by Toyota was after receiving an order from Brazil for 100 units of Model FXL large trucks. As Brazil was a developing country at the moment, it was a golden opportunity for Toyota to introduce its brand name overseas and, there was a high potential to penetrate the automobiles market in Brazil. But, because Brazil eventually had a poor infrastructure, Toyota grabbed this opportunity and marketed its Four-wheeled-Drive (4WD) Land Cruiser as this vehicle is able to withstand the poor road conditions of Brazil. Starting from this point, Toyota had Ipiranga, Brazil, and had the first-mover advantage to meet the demand locally. This enabled Toyota the chance to export its product to other Latin America nations like Colombia,

Costa Rica, Venezuela, and Puerto Rico. For South-East Asia, the first export was to Thailand which is in 1950s to 1960s. The action of Toyota Motor Sales to gain market in Thailand has enabled Toyota to receive for the second time the advantage as the first-mover in Thailand's local automobiles industry. And as for the Middle-East, it was in 1947 that the first exporting activity was being done by Toyota which was to the King of Egypt. During this period also Toyota had already started exporting its products to gain market in the automobiles industry in China. Toyota hesitated in exporting its products to Europe at first because Europe is known as the world's most sophisticated market. So, Toyota had no intention to do any transaction with Europe during that particular period. But, a European representative had come all the way to Tokyo asking Toyota to export its automobiles. As a result, Toyota exported its model, Crown and Land Cruisers to Denmark and Ethiopia.

After the expansion of products to Latin America, Toyota had expanded its automobiles to the North America Continent especially the United States of America. This is where the second stage of Toyota's Development Strategies took place. In this stage, Toyota implemented the Cross-Continent Space Strategy by establishing 5 assembly factories. However, due to the weather condition in the USA, it brought some difficulties to Toyota in promoting its vehicles. Thus, Toyota started to export the new Corona and Corolla to Canada. Another core factor that influenced Toyota to expand its cars to United States is due to the existence of large port cities in the West Coast Region that were crucial for Toyota in distributing its products to the USA. Toyota Crown was the first model that arrived in United States, specifically Los Angeles. After a while, Toyota's cars were being condemned as they vibrated badly and were easily overheated while driving all the way on the United State's highway. To replace the failure of Toyota Crown, Toyota had produced another improved car, Tiara, to the consumers of the USA. But, the Tiara also had not fulfilled the demand of the consumers and Toyota was having serious problems in selling its cars. From this, Toyota had learned its lesson—motor vehicles that were not competitive in performance, price, and brand names had no chances at all of being accepted by the markets. Until then, Toyota had been striving eminently to develop its new international product of the new Corona.

As for the development on the automobiles market in Thailand, Toyota had made a joint-venture with one of the car manufacturer of Thailand to become Toyota Motor Thailand. This later enabled Toyota to establish its own assembly plant in Thailand where it provided multiple job opportunities to the locals indirectly.

The expansion of Toyota's products continued to the West Region, then to the Central Region and lastly to the East Region of United States especially to New York City. This expansion process was successfully carried out with one of the factor of establishing the second wholly-owned subsidiary of Toyota which was located in Brazil. The expansion lead to a success when Toyota Do Brazil

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(TDB) merged with Toyota of Argentina to export Toyota's automobiles to Latin America and Central America. As Toyota was backed with high political influence due to its several contributions to the local politician during the election years, this guaranteed the successfulness of Toyota to the world generally.

Approaching 1970s, two major developments occurred to the Toyota manufacturer. First was the oil crisis. As the price of oil increased tremendously during the period, Toyota's cars were highly demanded as Toyota promoted a reasonable price on its cars. Another development which occurred was the appreciation of Japanese currency. For this reason, Toyota had to shift its manufacturing of high grade small cars to sporty cars. The examples are Celica and multi-use pick-up trucks.

The next strategy implemented was the establishment of the product plants. The main factor that lead Toyota to put this strategy into action was due to the oil crisis that eventually increased the number of units sold of Toyota's products. In January 1982, Toyota Motor Company (TMC) and Toyota Motor Sales (TMS) combined to form Toyota Motor Corporation. This restructuring and merger initiative was to grasp the capabilities of Toyota to the fullest. Toyota had been in a joint venture with General Motors (GM) with the reason that a voluntary restriction on Japanese exports to USA was initiated in 1981. This was after an action to joint-venture with Ford Motors failed. As a result, facilities of its own by Toyota being able to set up in the United States of America. The advantages towards this plan were to reduce risks and to accumulate experience in the local production. In this strategy also, Toyota decides to build production plants in developing countries and targeting places in urban cities like the Shenyang and Tianjin in China. In 1998, Toyota acquired Tianjin Motor Group to become Tianjin Toyota Motor Engine where they were in charge of supplying Daihatsu and later exporting it to Japan.

Up until 1995, Toyota implemented its third stage of development strategy which stressed on the globalization strategy. New global business plans were being initiated with the efforts to further localize (overseas) and increase imports of automobiles produced overseas (in Japan). One of the strategy made was the New Sienna which was made by the manufacturer of Toyota in Kentucky, USA. Other globalization plans that were made was the publication of supplier's guide with the intention to aim at providing the first timer suppliers a greater understanding on Toyota's purchasing activities and giving outlines on how to sell supplies to Toyota. In 1997, Toyota made another plan which provided internet services where it makes overseas supplier request for auto parts easier. As up to March 1998, Toyota had already had 34 overseas subsidiaries and affiliates throughout the world, 150 distributors in 5 continents and 25 countries. This indicates that Toyota has successfully entered the foreign market.

One key factor that lead Toyota to be able to expand effectively was due to the active role it played of a good corporate citizen. Toyota is actively donating

to social and cultural activities, exchange students programs and traffic safety campaign. This global business strategy has been a major plan for Toyota to keep consumers driving its products from generation to generation.

In short, all of the above strategies created by Toyota can be explained as; first, Toyota started to target the international market by focusing on the national level, then the global level. Ways of making its products known throughout the world are through exporting at first, joint ventures and later towards the establishing of Toyota's own subsidiaries to manufacture its products in the host country. After creating potential hopes on the 5 continents' market, Toyota began to be part of the local communities' choice of automobiles in their own country.

Source: *Scribd.com*

5.1 UNIT OBJECTIVES

After going through this unit, you will be able to:

- Describe the key elements of Total Quality Management
- Discuss Total Quality Management in global perspective
- Define business process reengineering
- Describe the quality standards
- Define quality manuals
- Identify the key barriers to Total Quality Management.

5.2 MEANING AND CONCEPT OF TOTAL QUALITY MANAGEMENT

TQM is a management approach in which quality is emphasized in every aspect of the business and organization. Its goals are aimed at long-term development of quality products and services. TQM breaks down every process or activity and emphasizes that each contributes or detracts from the quality and productivity of the organization as a whole. Management's role in TQM is to develop a quality strategy that is flexible enough to be adapted to every department, aligned with the organizational business objectives, and based on customer and stakeholder needs. Once the strategy is defined, it must be the motivating force to be deployed and communicated for it to be effective at all levels of the organization. Some degree of employee empowerment is also encompassed in the TQM strategy and usually involves both departmental and cross functional teams to develop strategies to solve quality problems and make suggestions for improvement.

5.2.1 Building Blocks of TQM

The building blocks of TQM can be classified into the following categories:

1. Processes
2. People
3. Management systems
4. Performance measurement

Process

Everything we do is a process, which is the transformation of a set of inputs, which can include action, methods and operations, into the desired outputs, which satisfy the customers' needs and expectations. In each area or function within an organisation there will be many processes taking place, and each can be analysed by an examination of the inputs and outputs to determine the action necessary to improve quality. In every organisation there are some very large processes, which are groups of smaller processes, called key or core business processes. These must be carried out well if an organisation is to achieve its mission and objectives. The section on processes discusses processes and how to improve them, and implementation covers how to prioritise and select the right process for improvement.

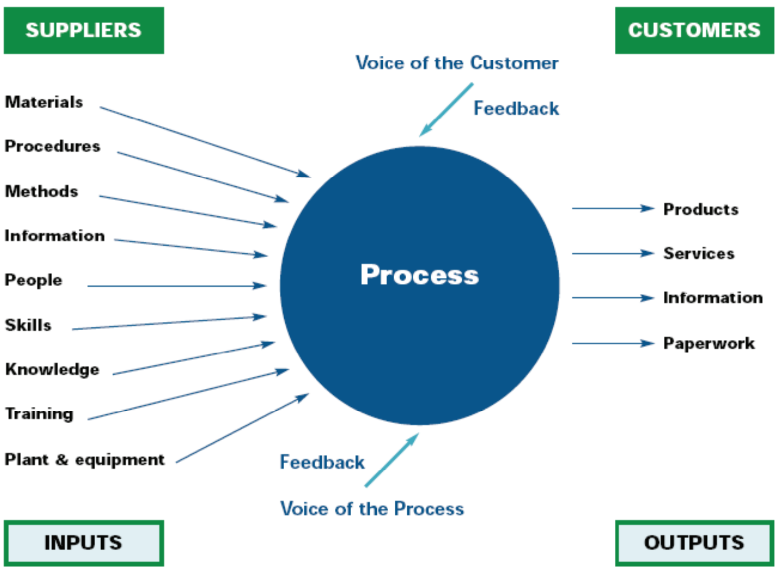


Fig. 5.1: TQM Process

People

The only point at which true responsibility for performance and quality can lie is with the people who actually do the job or carry out the process, each of which has one or several suppliers and customers.

An efficient and effective way to tackle process or quality improvement is through teamwork. However, people will not engage in improvement activities without commitment and recognition from the organisation's leaders, a climate for improvement and a strategy that is implemented thoughtfully and effectively. The section on people expands on these issues, covering roles within teams, team selection and development and models for successful teamwork.

Quality Management System

An appropriate documented Quality Management System will help an organisation not only to achieve the objectives set out in its policy and strategy, but also, and equally importantly, sustain and build upon them. It is imperative that the leaders take responsibility for the adoption and documentation of an appropriate management system in their organisation if they are serious about the quality journey. The systems section discusses the benefits of having such a system, how to set one up and successfully implement it.

Performance Measurement

Once the strategic direction for the organisation's quality journey has been set, it needs performance measures to monitor and control the journey, and to ensure the desired level of performance is being achieved and sustained. They can, and should be, established at all levels in the organisation, ideally being cascaded down and most effectively undertaken as team activities and this is discussed in the section on performance.

5.2.2 Models of TQM

Total Quality Management is a combined effort of both top level management as well as employees of an organization to formulate effective strategies and policies to deliver high quality products which not only meet but also exceed customer satisfaction. Total Quality Management enables employees to focus on quality than quantity and strive hard to excel in whatever they do. According to total quality management, customer feedbacks and expectations are most essential when it comes to formulating and implementing new strategies to deliver superior products than competitors and eventually yield higher revenues and profits for the organization.

Credits for the process of total quality management go to many philosophers and their teachings. Drucker, Juran, Deming, Ishikawa, Crosby, Feigenbaum and many other individuals who have in due course of time studied organizational management have contributed effectively to the process of total quality management.

There are many models of total quality management and it is really not necessary that every organization should select and implement the same model.

Following are the various models of total quality management:

- Deming Application Prize

- Malcolm Baldrige Criteria for Performance Excellence
- European Foundation for Quality Management
- ISO quality management standards

Customers and their feedback is the foundation of every Total Quality Management model. In simpler words, Total Quality Management begins with understanding customers, their needs and what they expect from the organization. Design foolproof processes and systems to collect customer data, information to further study, analyze and act accordingly. Such activities not only help you understand your target customers but also predict customer behaviour. As a business marketer, you need to know the age group of your target customers, their preferences and needs. Employees need to know how their products or services can fulfil customer needs and demands.

Total Quality Management model requires meticulous planning and research. Every total quality management model integrates customer feedback with relevant information and plans accordingly to design effective strategies to achieve high quality products. Strategies formulated to yield better quality products need to be evaluated and reviewed from time to time. Remember, customers are satisfied only when products meet their expectations, fulfil their needs and are value for money. Their overall experience with the organization needs to be pleasant for them to be happy and return to the organization even the next time. Continuous improvements, changes and modifications in the existing processes according to customer expectations are necessary to yield higher profits. Processes can't be the same always. If a customer complains about a particular product of yours, find out the root cause of the problem. Understand and implement necessary total quality management models to rectify the problem, remove the defect for a high quality product.

The successful implementation of Total Quality Management model needs extensive planning and most importantly participation of every single member who is benefitted out of the organization (Management, suppliers, clients and even customers).Without the participation of each and every employee, total quality management model would be a complete failure. Total Quality Management model begins with research and collecting information about end-users followed by planning and full participation of employees for successful implementation. Top level management needs to make other team members aware of the benefits of total quality management process, importance of quality to survive in the long run and how they can implement various TQM models by prioritizing their customers and their feedback.

5.2.3 Relevance and Importance of TQM

What is attempted in the whole process of TQM is to introduce a new cultural change, through changing the style of people management which is likely to bring about greater participation from the employees who would work with the management

to achieve the organisation goals and objectives. Management rewards comes from the following:

- Work itself becomes more interesting through greater involvement of employees;
- Increase in general productivity;
- Lower absenteeism because of greater job interest and satisfaction to employees;
- Fewer grievances among the employees;
- All round greater team spirit.

Top management must convey to middle management that it believes in TQM approach with the design of a deliberate policy. Middle management is expected to conduct the affairs keeping TQM policy in view, conveying the decision to supervisors. Once the entire organisation is geared to the change, the new culture would get engrained in the organisation leading to success.

A dramatic change is occurring in the scope and pace of technological advances that are contributing substantially to a fundamental shift in library and information products and services. This shift, although slow and halting in our country, is sure to affect the roles and responsibilities of professionals, alter working relationships and communication patterns, and a compulsion to provide alternatives to the existing information organisations. No longer can we talk about just computerisation of library and information services, but should examine the place of libraries in the context of information/ knowledge society. Information and communication technology has various components = microcomputers, telecommunications with local, national and international networks offering electronic mail and conferencing systems, CDROM and other optical disc formats, offering bibliographic, textual and graphic products etc., all suggesting major opportunities and challenges for libraries and information professionals.

The information context in which libraries and information professionals may have to operate will be far more different than ever in the past, with more complex issues to be addressed and an environment in which the pace of change is likely to be highly accelerated and the risks and competition much greater. As the shift from an industrial to an information-based economy takes place, there will be far more aggressive participants in the production, processing, dissemination and distribution of information than ever before. Competition will be forthcoming from product designers, computer experts, telecommunication specialists, publishers, management specialists and many others. There is likely to be an increasing emphasis on commercialisation of information and pricing of information would be a normal feature as against the current general view that information is a public good and should be available at no cost to a user. It must also be remembered that users will have many options to choose from to access information.

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The issues before library and information professionals is how to cope with the increasing demand for information from a variety of users, use of ICT to redefine services, roles and responsibilities. In fact the real issue would be to retain and reinforce the basic role of the library as a primary provider of information. The redefinition of the library, however, will have to be in relation to the future opportunities and challenges. The aim and effort are to transform the library into an institution of creativity, entrepreneurship, innovation and productivity vis-a-vis the information provision. It is against this background that we should examine management of libraries and information centres. The philosophy of participative management, involving every group of personnel to achieve total quality in every aspect of library and information work would now become relevant, meaningful and valuable. Total Quality Management which blends the principles and practices of scientific management and participative management has to be given a fair trial. Undoubtedly it is only with an abiding faith in this philosophy that this culture can take roots in the country.

5.2.4 Principles of TQM

Different companies have different approaches to implement Total Quality Management (TQM). The following principles (which are common to all companies) must be adhered for the successful Total Quality Management (TQM) implementation:

- **Continuous improvement:** TQM is a long-term process that entails achieving improvements in the company's operations. This means that management should establish targets for improvement and measure progress by using reliable criteria. The quest for quality and better service to the customer should be a continual, never-ending one. Competitors will seek to provide better service and customers will come to expect it. Hence, to cease improvement efforts will likely lead to loss of competitive advantage and a decreased level of customer satisfaction.
- **Customer focus:** In TQM, the customer is believed to be the ultimate judge of quality. Therefore, the company must remain close to the customer and understand how he or she views and judges quality.
- **Strategic planning and leadership:** Achieving quality and market leadership requires a viable competitive strategy that outlines goals and desired outcomes. Moreover, senior executives should be responsible for introducing and supporting TQM programs.
- **Competitive benchmarking:** This means identifying companies or other organizations that are the best at something and then modeling your own organization after them. The company need not be in the same line of business as yours.

- **Employee empowerment:** TQM is based on humanistic management principles that suggest employee involvement and participation is essential for success. Giving workers the responsibility for improvements and the authority to make changes to accomplish them provides strong motivation for employees. This puts decision making into the hands of those who are closest to the job and have considerable insight into problems and solutions. Empowered to bring about changes in their workplace, employees can creatively contribute to their company's well being.
- **Teamwork approach:** The use of teams for problem solving and to achieve consensus takes advantage of group thinking, gets people involved, and promotes a spirit of cooperation and shared values among employees. Further, teamwork creates opportunities for learning and exchanging ideas.
- **Knowledge of tools:** Everyone in the organization is trained in the use of quality control and improvement tools.

The entire organization must be subject to the search for improved ways of performing; nothing should be regarded as sacred or untouchable. A sometimes helpful view is to consider the internal customers and strive to satisfy them; that is, every activity in an organization has one or more customers who receive its output. By thinking in terms of what is needed to satisfy these customers, it is often possible to improve the system and, in doing so, increase the satisfaction of the final customer.

5.3 ELEMENTS OF TQM

TQM has been coined to describe a philosophy that makes quality the driving force behind leadership, design, planning, and improvement initiatives. For this, TQM requires the help of those eight key elements. These elements can be divided into four groups according to their function. The groups are:

1. Foundation – It includes: Ethics, Integrity and Trust
2. Building Bricks – It includes: Training, Teamwork and Leadership
3. Binding Mortar – It includes: Communication
4. Roof – It includes: Recognition.

1. Foundation

TQM is built on a foundation of ethics, integrity and trust. It fosters openness, fairness and sincerity and allows involvement by everyone. This is the key to unlocking the ultimate potential of TQM. These three elements move together, however, each element offers something different to the TQM concept.

(a) **Ethics**: Ethics is the discipline concerned with good and bad in any situation. It is a two-faceted subject represented by organizational and individual ethics. Organizational ethics establish a business code of

ethics that outlines guidelines that all employees are to adhere to in the performance of their work. Individual ethics include personal rights or wrongs.

(b) **Integrity:** Integrity implies honesty, morals, values, fairness, and adherence to the facts and sincerity. The characteristic is what customers (internal or external) expect and deserve to receive. People see the opposite of integrity as duplicity. TQM will not work in an atmosphere of duplicity.

(c) **Trust:** Trust is a by-product of integrity and ethical conduct. Without trust, the framework of TQM cannot be built. Trust fosters full participation of all members. It allows empowerment that encourages pride ownership and it encourages commitment. It allows decision making at appropriate levels in the organization, fosters individual risk-taking for continuous improvement and helps to ensure that measurements focus on improvement of process and are not used to contend people. Trust is essential to ensure customer satisfaction. So, trust builds the cooperative environment essential for TQM.

2. Bricks

Basing on the strong foundation of trust, ethics and integrity, bricks are placed to reach the roof of recognition. It includes:

(a) **Training:** Training is very important for employees to be highly productive. Supervisors are solely responsible for implementing TQM within their departments, and teaching their employees the philosophies of TQM. Training that employees require are interpersonal skills, the ability to function within teams, problem solving, decision making, job management, performance analysis and improvement, business economics and technical skills. During the creation and formation of TQM, employees are trained so that they can become effective employees for the company.

(b) **Teamwork:** To become successful in business, teamwork is also a key element of TQM. With the use of teams, the business will receive quicker and better solutions to problems. Teams also provide more permanent improvements in processes and operations. In teams, people feel more comfortable bringing up problems that may occur, and can get help from other workers to find a solution and put into place. There are mainly three types of teams that TQM organizations adopt:

Quality improvement teams or excellence teams (QITs): These are temporary teams with the purpose of dealing with specific problems that often recur. These teams are set up for a period of three to twelve months.

Problem solving teams (PSTs): These are temporary teams to solve certain problems and also to identify and overcome causes of problems. They generally last from one week to three months.

Natural work teams (NWTs): These teams consist of small groups of skilled workers who share tasks and responsibilities. These teams use concepts such as employee involvement teams, self-managing teams and quality circles. These teams generally work for one to two hours a week.

(c) **Leadership:** It is possibly the most important element in TQM. It appears everywhere in an organization. Leadership in TQM requires the manager to provide an inspiring vision, make strategic directions that are understood by all and to instill values that guide subordinates. For TQM to be successful in the business, the supervisor must be committed in leading his employees. A supervisor must understand TQM, believe in it and then demonstrate their belief and commitment through their daily practices of TQM. The supervisor makes sure that strategies, philosophies, values and goals are transmitted down throughout the organization to provide focus, clarity and direction. A key point is that TQM has to be introduced and led by top management. Commitment and personal involvement is required from top management in creating and deploying clear quality values and goals consistent with the objectives of the company and in creating and deploying well defined systems, methods and performance measures for achieving those goals.

3. Binding Mortar

(a) **Communication:** It binds everything together. Starting from foundation to roof of the TQM house, everything is bound by strong mortar of communication. It acts as a vital link between all elements of TQM. Communication means a common understanding of ideas between the sender and the receiver. The success of TQM demands communication with and among all the organization members, suppliers and customers. Supervisors must keep open airways where employees can send and receive information about the TQM process. Communication coupled with the sharing of correct information is vital. For communication to be credible the message must be clear and receiver must interpret in the way the sender intended.

There are different ways of communication such as:

Downward communication: This is the dominant form of communication in an organization. Presentations and discussions basically do it. By this the supervisors are able to make the employees understand TQM.

*Upward c*ommunication: By this the lower level of employees are able to provide suggestions to upper management of the affects of TQM. As employees provide insight and constructive criticism, supervisors must

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listen effectively to correct the situation that comes about through the use of TQM. This forms a level of trust between supervisors and employees. This is also similar to empowering communication, where supervisors keep open ears and listen to others.

Sideways communication: This type of communication is important because it breaks down barriers between departments. It also allows dealing with customers and suppliers in a more professional manner.

4. Roof

(a) **Recognition:** Recognition is the last and final element in the entire system. It should be provided for both suggestions and achievements for teams as well as individuals. Employees strive to receive recognition for themselves and their teams. Detecting and recognizing contributors is the most important job of a supervisor. As people are recognized, there can be huge changes in self-esteem, productivity, quality and the amount of effort exhorted to the task at hand. Recognition comes in its best form when it is immediately following an action that an employee has performed. Recognition comes in different ways, places and time such as,

Ways: It can be by way of a personal letter from top management and also by award banquets, plaques, trophies etc.

Places: Good performers can be recognized in front of departments, on performance boards and also in front of top management.

Time: Recognition can be given at any time like in a staff meeting, annual award banquets, etc.

5.4 TOTAL QUALITY MANAGEMENT IN GLOBAL PERSPECTIVE

The principles of Total Quality Management (TQM) are now a recognized characteristic of most of successful businesses the world over. Customers' changing demands, the awesome penetration of Japan (Asian Lion) and its Pacific Rim neighbors, viz, South Korea, Taiwan, Singapore and Hong Kong (called Asian Tigers) into the US and western markets and the need for stringent cost management in fluctuating environment, make TQM a practice of paramount importance for every enterprise, big or small. Gone are the days when customers considered price as the main reason for purchasing a product or service. Quality and reliability are now the overriding factors which customers favour in exercising choice. Meeting customer specifications, dependability of service and speed of delivery are the very distinguishing features of success. No other theory of business management addresses these issues more fully than TQM.

TQM has become a vast enterprise in the twenty-first century as consulting firms specialize in quality work. Nation-wide training programs are organized on the

Check Your Progress

1. What do you mean by total quality management?
2. Define integrity.
3. What do you mean by problem solving teams?
4. Define communication.

basic principles of TQM and numerous national associations, including the American Society for Quality and the Association for Quality and Participation, are emerging (Levy, 2003). In the spirit of management diffusion, TQM was exported to other countries like the UK. In the UK TQM gained recognition from the activities of the Department of Trade and Industry's National Quality Campaign, this was launched in 1983, with the pioneering work of organizations like IBM (Dale et al., 1994).

The global perspective on TQM has helped to create a combination of what works in many different cultures. Although TQM was originally developed for manufacturing organizations, it has also been adapted for service organizations, including educational institutions (Birnbaum, 2001; Muchinsky, 2003). Easton and Jarrell (1998) conducted empirical research in 108 organizations to determine the impact of TQM, using financial data as parameters for business success. The financial data were based on net income, sales, operational income, and daily return stocks. Two groups were formed from the 108 firms, which were split according to how advanced the TQM process was in the organizations. A total of 44 firms were classified as more advanced, while 64 firms were considered less advanced. The more advanced organizations were reported as more successful; a derivative of effort in implementing TQM into the organization. In another empirical study, 84 percent of Fortune 1,000 companies surveyed said that they had great success pursuing both TQM and employee involvement (Watson and Korukonda, 1995). Other researchers like Hackman and Wageman (1995) also found support for TQM, based on empirical data. Lawler et al. (1995) found that a very high percentage (83 percent) of companies that adopted TQM reported their experiences with the program as being positive or very positive

5.5 GLOBAL BENCHMARKING

Benchmarking is a strategy that is often employed to assess the level of overall performance of a company operating within a specific industry. Benchmarks themselves are those standards of excellence for productivity, quality, service delivery, and cost that are recognized as being the ideal within that particular field. The process of benchmarking helps a business to have an idea of its overall standing within the community, and make it possible to identify areas where there is room for improvement.

The establishment of a benchmark within an industry or profession does not appear overnight. Often, the benchmark is created over a number of years. From that point on, any new business entering the same field will judge their overall performance against the standards already in place within the industry. Those standards remain the norm until a competitor exhibits qualities that exceed the standard, and thus raise the benchmark for all other companies within the industry.

A prime example of benchmarking can be seen in the field of telecommunications during the second half of the 20th century. Prior to the deregulation of the telephone

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industry in the United States during 1984, one company had established itself in terms of products, service delivery, and customer care. In order for emerging companies to compete, it was necessary to at least match those same standards with a lower rate, or to surpass those standards while still maintaining a rate that consumers would find attractive. The end result is that the overall benchmark for telecommunications within the United States began to change, as companies vied for the honor of setting the new industry standard.

Internally, benchmarking is one of the most effective strategies a company can use to position itself for growth. Because the proper assessment of how the company measures up to the industry standard relies on being brutally honest about policies, procedures, pricing, and service delivery, companies can get a better idea of exactly where they need to improve in order to increase market share, or even to maintain the share of the market they currently command. When used effectively, benchmarking can lead a company to become more innovative, think about their business model in new ways, and even identify new consumer markets that could be targeted, thus increasing the overall sales generated by the company.

It is important to note that benchmarking is not a process that is conducted once in a while, and then set aside for a few years. Companies that want to remain competitive are constantly in the process of evaluating their practices and procedures against the standards for their industries, and looking for ways to meet or exceed those standards. In a time when technology is constantly changing the way consumers make decisions on what to buy and who to buy it from, benchmarking has taken on even more importance for companies that want to be in business for many years to come.

The Benchmarking Process

Camp (1989) lists the following steps for the benchmarking process:

1. **Planning:**
   (a) Identify what is to be benchmarked
   (b) Identify comparative companies
   (c) Determine data collection method and collect data
2. **Analysis**
   (a) Determine current performance "gap"
   (b) Project future performance levels
3. **Integration**
   (a) Communicate benchmark findings and gain acceptance
   (b) Establish functional goals
4. **Action**
   (a) Develop action plans

(b) Implement specific actions and monitor progress

(c) Recalibrate benchmarks

5. **Maturity**

(a) Leadership position attained

(b) Practices fully integrated into process

The first step in benchmarking is determining what to benchmark. To focus the benchmarking initiative on critical issues, begin by identifying the process outputs most important to the customers of that process (i.e., the key quality characteristics). This step applies to every organizational function, since each one has outputs and customers. The QFD/customer needs assessment is a natural precursor to benchmarking activities.

5.6 BUSINESS PROCESS REENGINEERING

Business Process Reengineering is an approach to the positioning of a business enterprise by essentially redesigning the structure of the business from the ground up. This radical approach seeks to interpret the standard business model in a new way, making more efficient use of available resources by seeing the function and purpose of those resources in new ways. The working structure for Business Process Reengineering is examined in great deal in a 1993 work entitled Reengineering the Corporation: a Manifesto for Business Revolution.

The architects of Business Process Reengineering are Michael Hammer and James Champy. Throughout the later 1980s, Champy and Hammer worked to define the process that would allow businesses to depart from using a time-honored but possibly no longer timely model, and build something new and radical. This approach did not necessarily call for the complete abandonment of all aspects of the standard business model. However, the approach did call for redefining each component in the model and altering the function in a manner that would produce a business structure relevant for a new age.

Over the years, Business Process Reengineering has been known by many different titles. In some instances, the process is known simply as BPR. At other times, the approach has been called Business Process Redesign, Business Transformation, and Business Process Change Management. All these titles do speak to the foundational tenet of the process, in that the idea is to free a business from following the same old structure, simply because that is the way it has always been done. Instead, Business Process Reengineering, under all its different names, supports tearing down the business structure to the foundation and building it anew.

One of the main tools that Business Process Reengineering identifies as an agent for change is the technology of the new millennium. This means that much of the computer technology that became readily available to even small businesses during the 1990s would help business owners to rethink how to structure their

businesses. Some examples of how this has proven to be true include shared databases, communication networks that allow real-time interaction with multiple company sites, and wireless devices that allow work to take place outside the office.

A successful BPR implementation brings significant improvement to productivity, customer service and bottomline. There are pain and difficulties during implementation and instances where BPR efforts did not achieve desired result. Notwithstanding, the risk is worth taking. Otherwise, there will be greater risk of being overtaken by competitors who develop and progress rapidly through BPR.

Implementation phases

- **Project kick off:** Project goal, project team and communication standards are agreed upon. A number of workshops are held where project scope, sponsors commitment, project risk, milestones and deliverables are discussed. A SWOT (strength, weakness, opportunities and threat) analysis is carried out with active participation of all.
- **Process identification and data gathering:** "As is" processes are assembled through flow charts. Current practice of interfacing with business partners is gathered. Bottlenecks, delays, complexity, internal blame games, idle assets etc. are brought forward. Use of existing technologies is comprehended. Major and strategic business processes to be reengineered, are identified. Stakeholders categorize the processes to be reengineered and agreed upon on the timeline of implementation.
- **Process Reengineering:** In this phase, actual reengineering begins. A number of brain-storming sessions are held with project team and other stakeholders, where current business processes are critically analyzed to determine non-value adding activities and identify excess control and check, always with customer value as a focal point. Impact of new technologies on process improvement is also evaluated. New process ideas with reduced check and control and enabling technologies such as workflow automation and ERP, are envisaged. Benchmarking is also done with best of breed industrial peers.
- **Blueprint of new system:** Blueprinting involves modeling workflow and information requirement, of new business processes. "To be" processes are modeled using various modeling tools. New organization structures, human resource need, performance monitoring and compensation, technological needs, are also outlined. Normally, a first cut redesign scheme is produced which is modified after gathering actionable feedback from the stakeholders.
- **Transformation:** A migration strategy and a migration plan is the first step of transformation. Migration strategy may be decided as a pilot, phased or big bang implementation. The migration plan would include establishment of new organizational structure, detailed training and reallocation of workforce, and cut off dates for implementation. Change management and introduction of new technologies will form an important part and may need engagement of outside

consultants for this specific purpose. There should be provision on the plan to tweak the implemented system so as to get maximum value out of it.

Business Process Reengineering (BPR) and Total Quality Management (TQM)

Total Quality Management and BPR share a cross-functional relationship. Quality specialists tend to focus on incremental change and gradual improvement of processes, while proponents of reengineering often seek radical redesign and drastic improvement of processes. Quality management often referred to as TQM or continuous improvement, means programs and initiatives, which emphasize incremental improvement in work processes, and outputs over an open-ended period of time. In contrast, reengineering, also known as business process redesign or process innovation, refers to prudent initiatives intended to achieve radically redesigned and improved work processes in a specific time-frame. In contrast to continuous improvement, BPR relies on a different school of thought. The extreme difference between continuous process improvement and business process reengineering lies in where you start from and also the magnitude and rate of resulting changes. In course of time, many derivatives of radical, breakthrough improvement and continuous improvement have emerged to address the difficulties of implementing major changes in corporations. Leadership is really important for effective BPR deployment, and successful leaders use leadership styles to suit the particular situation and perform their tasks, giving due importance to both people and work. Business process is essentially value engineering applied to the system to bring forth, and sustain the product with an emphasis on information flow. By mapping the functions of the business process, low value functions can be identified and eliminated, thus reducing cost. Alternatively, a new and less costly process, which implements the function of the current process, can be developed to replace the present one.

The role of executive leadership or top management in business process reengineering cannot be disregarded. They should provide the needed resources to the team, demonstrate their active support for the project, set the stage for reengineering by determining core business processes, and by defining the project scope and objectives. The management should also take care to provide adequate funding, set new standards as well as encourage others to be open to innovative approaches. Many reengineering projects fail to be completed or do not achieve bottomline business results. For this reason alone, business process reengineering 'success factors' has become an important area of study. Success factors are a collection of lessons learnt from previous projects. It is useful to think of your team structure in 3 levels: stakeholders, core team, and extended team.

The stakeholders are key business leaders ultimately accountable for the success of the project. Their role is to provide high-level guidance to the team, help remove barriers, and provide funding. The core team is the group responsible for the design and implementation of the solution. Your extended team includes other people in the organization contributing to the project on an as-needed basis. These extended-team

members include subject-matter experts. A well-rounded team includes a mix of people and skills. Such a team may include individuals who thoroughly understand the current process, who actively use the process and also work closely with customers, technical experts, and consultants, if necessary. But the main criterion is that the entire team should work together for the project to succeed.

5.7 GLOBAL STANDARDS

Standards crystallize past experience and knowledge. It would be no exaggeration to say that industrial production efficiency depends on the number of effective standards set and utilized. However, some people believe that standards are enslaving and stifle creativity. To set effective standards, it is first necessary to understand correctly what standards actually are. The basic requirement of industrial production is to manufacture, as cheaply as possible, products that satisfy consumer demand. Ways of reducing costs include purchasing materials cheaply and making use of cheap labor. These are management devices, not technical ones. Technical measures might include lowering materials consumption per product unit or raising per-capita value-adding productivity. Raising productivity through technology basically involved using scientific laws and principles in the production process. Modern industry is based on scientific progress, and the application of science to manufacturing has enabled the mass production of sophisticated products that were previously unimaginable. Industrial production is achieved through a wide-ranging application of known scientific laws and principles in such diverse fields as mechanics, thermodynamics, strength of materials, electro-magnetic, vibration science, metallurgy, chemistry, biology, and so on.

Standards constituting social or business conventions are imposed for reasons of convenience or safety. Depending on what they cover, they are prescribed in the form of national, industrial, company, and divisional standards. Unlike standards based on natural lay, they are not absolute; with this type of standard, people are free to choose what is specified. The appropriateness of a standard of this type can be verified by weighing up the social disadvantages that would arise if it did not exist. If dispensing with such a standard would cause no problems, it is probably a meaningless restriction and ought to be abolished.

ISO 9000 is a series of quality management systems (QMS) standards created by the International Organization for Standardization, a federation of 132 national standards bodies. The ISO 9000 QMS standards are not specific to products or services, but apply to the processes that create them. The standards are generic in nature so that they can be used by manufacturing and service industries anywhere in the world. An organization that would like to have ISO certification needs to meet all the criteria stated in the ISO standards and passes a detailed audit performed by an ISO auditor. In some industries ISO certification has become necessary; for example, some large manufacturers require all suppliers to be ISO certified. While

ISO certification is highly respected, if it is not a trend in your specific industry, the additional cost of certification is a deterrent to most managers. It is very possible to reach the desired quality level within an organization with a well planned quality system and without going through all the additional steps for ISO certification. QS-9000, released in 1994, is the ISO 9000 derivative for suppliers to the automotive Big Three: DaimlerChrysler, Ford, and General Motors. This quality management system standard contains all of ISO 9001:1994, along with automotive sector-specific, Big Three, and other original equipment manufacturer (OEM) customer specific requirements.

5.8 ISO 9000 SERIES

The ISO 9000 originated from the quality standards of the US Department of Defense. The British Standards Institution (BSI) adopted the Department of Defense standards and expanded it to include the whole business process. The BS 5750 was published in 1979 to include broad range of business and organisations. At the same time EN 29000 was developed to cover the European Community. In 1987 International Standards organisation adopted the BS 5750 standard and the ISO 9000 series was published. The ISO 9000 though mainly based on BS 5750 standard reflects the international requirement. The success of ISO 9000 lies in the fact that the three standards ISO 9000, BS 5750 and EN29000 have been harmonized and are now equivalent. The ISO series comprises 9000,.9001, 9002, 9003 and 9004. The details are provided in the table 5.1:

Table 5.1: ISO 9000 Series

Standard	Title	Coverage
IS 09000	Guide to selection and use	Defines elements of each standard. It covers quality management and general guidelines for selection and use.
ISO 9(X) 1	Specification for design	Model for quality assurance in design, development, production, installation and servicing,
IS 09002	Specification for producton	Model for quality assurance and installation in production and installation.
IS09003	Specification for final inspection and testing	Model for quality assurance in final inspection and testing
IS090004	Quality management and quality systems elements	It covers quality management and quality system elements of standards guidelines 9001 to 9003. Provides guidelines for development and implementation of quality system.

The ISO 9000 series does not lay down goals and objectives; it rather provides a framework, methods and structure for organisations to adopt quality systems. It is applicable to virtually any type of organisation. The standards have been developed keeping the manufacturing units in mind. As a result it is not very useful for the service sector. These standards are for quality management systems and go beyond technical specifications. The emphasis of ISO 9000 is to assure that the manufacturer's products are consistently same always even if all employees are changed over a period of time. For this purpose documentation is strongly recommended. Three sets of documentation are required for the purpose:

- **Quality Manual:** Covering quality policy and objectives of the organisation; organisation chart and the statement of responsibility of each person in the organisation.
- **Procedure Manual:** Showing flow charts indicating the different procedures in the organisation.
- **Work Instruction:** Detailed instruction for specific tasks that are carried out everyday.

For registration to ISO 9000, a third party audit needs to be carried out by the organisation. Registration is process-based and not product-based. The company is assessed on the basis of the documentation of what it does and how far it complies with the documented facts.

5.8.1 ISO 9000 vis-a-vis TQM

ISO 9000 though advisory in nature could be a valuable component of TQM. While ISO 9000 points out the fault areas, the TQM provides ways and means to tackle these faults. Implementation of ISO 9000 requires the organisation to focus on customer needs and fulfill the quality requirement. The rote ration of IS0 9000 in TQM system would require every product or service to meet the customer needs' and agreed specifications. Therefore, it could be seen as a valuable component of TQM.

5.8.2 ISO 9000 in Libraries and Information Centers

Library and Information Center activities cover acquisition, processing and dissemination of information. User satisfaction is crucial to its activities. Therefore, implementation of ISO 9000 in library/information center could be quite helpful in providing quality services to its users. Library and information centers are generally part of a parent organisation and hence its objectives and goals are guided by the organisation's overall objectives and goals. Registration for the standards will generally depend on whether the organisation is adopting it or not and it will adopt it as a part, of the organisation. The standards are generally meant for manufacturing organisation and most part of it may not be relevant for the library at all. However, some part of it could be adopted, for instance the requirement of documentation of the processes. The requirement for documentation is quite challenging and new efforts are needed for the purpose. Adhering to the standards will help in identifying

the gaps and loopholes and out of date practices in the library. It can provide a framework for managing processes and operations of the library. The documentation requirement will enable it to standardise procedures and stick to the documented quality specification.

5.9 ENVIRONMENT QS 14000

The ISO 14000 family addresses various aspects of environmental management. It provides practical tools for companies and organizations looking to identify and control their environmental impact and constantly improve their environmental performance. ISO 14001:2004 and ISO 14004:2004 focus on environmental management systems. The other standards in the family focus on specific environmental aspects such as life cycle analysis, communication and auditing.

ISO 14000, which was initially released in 1996 and updated in 2004, is a global series of environmental management systems (EMS) standards. As a continuation of the standardization process that was initiated with the ISO 9000 series, the ISO 14000 series of international standards have been developed so that organizations may incorporate environmental aspects into operations and product standards. It is a set of voluntary environmental management standards, guides and technical reports, which specifically focuses on corporate environmental management systems, operating practices, products, and services. The ISO standards in general aim to facilitate international trade and commerce. Companies can implement any or all of the ISO 14000 series standards. They do not prescribe environmental performance targets, but provide organizations with the tools to assess and control the impact of their activities, products or services on the environment.

The ISO 14000 series addresses the following aspects of environmental management:

- Environmental Management Systems (EMS)
- Environmental Auditing & Related Investigations (EA&RI)
- Environmental Labels and Declarations (EL)
- Environmental Performance Evaluation (EPE)
- Life Cycle Assessment (LCA)
- Terms and Definitions (T&D)

Compliance to an ISO 14000 EMS:

- Assures customers of your commitment to demonstrable environmental management
- Maintains excellent public relations
- Satisfies investor criteria and improves access to capital
- Obtains insurance at reasonable cost

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- Enhances your image and market share
- Meets your clients' registration requirements
- Improves cost control by identifying and eliminating waste and inefficiency
- Lessens incidents that result in liability
- Reduces your consumption of materials and energy
- Facilitates the attainment of permits and authorizations
- Decreases the cost of complying with environmental regulations
- Improves industry-government relations.

ISO 14000 registration

With respect to ISO 14000, registration is the formal recognition of an organization's ability to conform to the requirements of an EMS. Organizations may simply declare that their EMS meets the requirements of ISO 14001 ("self-declaration"). However, many organizations choose to have their EMS registered, usually to provide greater assurance to clients and the public, or because regulators and clients require it.

What are the principles behind the ISO 14000 series?

The ISO 14000 standards and documents are being developed with the following key principles in mind:

- To result in better environmental management
- To encompass environmental management systems and the environmental aspects of products
- To be applicable in all countries
- To promote the broader interests of the public as well as users of these standards
- To be cost-effective, non-prescriptive and flexible so they are able to meet the differing needs of organizations of any type or size, worldwide
- As part of their flexibility, to be suitable for internal and/or external verification
- To be scientifically based
- Above all, to be practical, useful and usable.

ISO 14000 standards- "Organization" and "Product" oriented

The ISO 14000 series fall into two major groupings: organization-oriented and product-oriented documents. The organization-oriented standards provide complete guidance for establishing, maintaining and evaluating an EMS. They are also concerned with other organization-wide environmental systems and functions.

The following is a list of the published organization-oriented ISO 14000 standards, TRs and guides:

- ISO 14001:2004, Environmental Management Systems-Specification With Guidance for Use
- ISO 14004:2004, Environmental Management Systems-General Guidelines on Principles, Systems and Supporting Techniques
- ISO 14010:1996, Guidelines for Environmental Auditing-General Principles
- ISO 14011:1996, Guidelines for Environmental Auditing-Audit Procedures-Auditing of Environmental Management Systems
- ISO 14012:1996, Guidelines for Environmental Auditing-Qualification Criteria for Environmental Auditors
- ISO 14031:1999, Environmental Management-Environmental Performance Evaluation-Guidelines
- ISO/TR 14032:1999, Environmental Management-Examples of Environmental Performance Evaluation (EPE)
- ISO/TR 14061:1998, Information to Assist Forestry Organizations in the Use of Environmental Management System Standards ISO 14001 and ISO 14004

The product-oriented standards are concerned with determining the environmental aspects and impacts of products or services over their life cycles, and with the application of environmental labels and declarations on or to products. These standards assist an organization in assembling the data needed to support planning and decision-making, and to communicate specific environmental information about a product/service to customers, end-users, and other interested parties.

ISO 14000 and International Trade

ISO endeavors to avoid the creation of unnecessary barriers to trade. The objective of environmental management standards has been to develop a common language platform for environmental issues, so that businesses, prospective customers, and governments are certain that all organizational level environmental concerns have been addressed. By focusing on management and product standards, and emphasizing guidance over strict specifications in its documents, ISO 14000 has created a positive ambience for world trade, at the same time encouraging progress in environmental performance.

5.10 QUALITY MANUAL

A quality manual is a document stating the quality policy and describing the quality system of an organization (ISO 8402, 1994). It includes the firm's quality policy and addresses each of the requirements of ISO 9000 in broad terms related to the activities of the firm. In drawing up a quality manual, various people in the firm should be involved and relevant ISO 9000 standards referenced. The manual should be terse and easy to understand. Prior to issuing the manual, it should be subjected to review

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by responsible individuals to ensure clarity, accuracy, suitability, and proper structure. Finally, it must be reviewed and approved by the general manager (Bergman and Klefsjö, 1994; Burrill and Ledolter, 1999; Dale, 1999; Randall, 1995). The quality function shall establish, implement, and maintain a documented quality system as a means of ensuring that products and services conform to specified requirements. This documented system shall include this Quality Manual supported with detailed procedures and specifications as described in Quality Specification (Total Quality Management Documentation System). This manual provides a guide for design, manufacture and marketing of Tyco Electronics products. It represents official policy and shall be used as a standard by all Business Units and operations of Tyco Electronics (as defined by the Scope) in developing and administering systems for continual improvement and the control of quality and reliability of products and services.

The documented quality system shall provide for timely consideration of the following activities in meeting specified requirements:

- Quality planning;
- The identification and facilitation of controls, processes, inspection, equipment, fixtures, production resources, and skills that may be needed to achieve the required quality;
- The updating, as necessary, of quality control, inspection, and testing techniques, including the development and acquisition of new instrumentation;
- The clarification and documentation of standards of acceptability for all features and requirements, including those which may contain a subjective element;
- For the entire product life cycle, ensuring the compatibility of the design, support services, production process, installation, inspection and test procedures, and the accuracy of the applicable documentation;
- The identification of suitable verification at appropriate stages of product or service development;
- The identification, preparation, and maintenance of quality records.

5.11 BARRIERS TO TOTAL QUALITY MANAGEMENT

The implementation of TQM in business organisations provides an opportunity to update and enhance the abilities of the staff to work effectively, yet it is still not free from some barriers. These could be listed as under:

- **The vocabulary barrier:** The words “total”, “quality” and “management” imply that a standard are not already being observed, nor is quality work valued.
- **The commitment barrier:** TQM requires long-term commitment, perhaps even longer in the service sectors like libraries and information centres. Cultural change which cannot be accomplished over-night or in a year may be positive

changes, particularly in staff attitudes and learning, but they should occur early in the process.

- **The process barrier:** Sometimes the process merely represents a desire to postpone decision making or reluctance to resolve the issue. We should learn to define problems better at the outset and then give them the kind of systematic analysis which can lead to lasting solutions.
- **The professional barrier:** The higher the degree of professionalisation within an organization, the greater the resistance to certain elements of TQM, particularly its customer focus. Professionals simply are mystified by, if not fearful of, the consequences of what they think could mean turning over their services and practices, which are based on tradition, standards and respected bodies of knowledge, to the uninformed whims of customers.

Case Study: Strategy of Ryanair

Overview of the Company: Ryanair

Ryanair started in the year 1985 with only 57 staff members and with one 15 seater turboprop plane from the south of east of Ireland to London-Gatwick which carried 5000 passengers on one route (2002). In 1986, inspired from the story of the company to go after the big guys for a slice of the action and end up smashing the British Airways high fare cartel on the Dublin-London route. The staff increased from mere 57 to 120 staff members and the plane carried for about 82,000 passengers on two routes. In 1989, the company employed 350 staff and their average maximum passengers increased to 600,000. In 1990-1991, the company has 700,000 passengers.

However, despite the increase of passengers, the company is not so good in managing cost that the company has lose its money. A new management team is brought in to sort it out and re-launch as a “low fares or no frills” airline, closely modelling the Southwest Airlines model in the U.S. In 1994, Ryanair bought its first Boeing 737 aircraft which carried over 1.5 million passengers. In 1995, Ryanair was the biggest passenger carrier on Dublin-London route, the largest Irish airline on every route operated and carried 2.25 million passengers in the year 2002.

In 1997, the EU air transport deregulation allowed the airline for the first time to open up new routes to Continental Europe with over 3 million passengers on 18 routes. Ryanair launched services to Stockholm, Oslo, Paris and Brussels and took time out to float Ryanair plc on Dublin and NASDAQ stock exchanges. The company was awarded as Airline of the Year in 1999 by the Irish Air Transport Users Committee.

In 2000, they announced the launch of 10 new European routes for the summer 2000 after much deliberation and watching others burning money. The company has also jumped onto the internet with the launch of their new online booking site and in just 3 months the site is taking over 50,000 bookings a week. By 2001 there are more than 1500 employees working for Ryanair and more than 10 million passengers are carried to 56 cities in 13 European countries. The company has opened Frankfurt-Hahn in 2002 as their second continental European base and announced a long-term partnership with Boeing which will see the company acquiring up to 150 new Boeing 737-800 series aircraft over an eight year period from 2002-2010.

The booking in their web accounts have increased to 94% which has probably has something to do with opening another 26 routes. In the year 2003, the company was characterised by rapid expansion and started the year by announcing that the company had ordered an additional 100 new Boeing 737-800 series aircraft to facilitate the rapid European growth plans (2002). They acquired Buss from KLM in April and re-launched 13 buss routes in May. In February they opened their first base in Italy at Milan-Bergamo and launched their Stockholm base in Sweden with six new European routes. In all 60 new routes are added throughout 2003 to bring the company a total of 127 routes. By 2004, the company was named as the most popular airline on the web by Google and they launched their 10th and 11th bases in Rome Ciampino and Barcelona Girona and continue to add more routes to their already extensive network. The company has also passed out British Airways to become UK's favourite airline in United Kingdom and throughout Europe (2002).

Critical Success Factors

Although the company had encountered different problems, specifically in line with its cost structures, the company had been able to survive and grow in the marketplace. Ryanair implemented different marketing strategy to make the company survive in the competition and to be able to gain competitive position in the airline market. It is said that the company was regarded recently as the most punctual airline between Dublin and London. And because of the strategy of the industry, Ryanair is now recognised as the second-largest airline in United Kingdom and Europe's largest low-fares airline having a network of over 57 routes in 11 countries and served by a fleet of 31 Boeing 737-200 and -800 aircraft with over 1,400 staff and personnel.

In order to position itself in the marketplace the company continuously concentrates on driving its costs to offer the lowest fares possible and remain profitable. In addition, Ryanair offers minimum standards of service and very low prices for point-to-point, short haul flights. The goal of Ryanair is to meet the needs of travelling at the lowest price. The Critical Success Factors (CSFs) are as follows in the airline industry: the strategic focus of having the lowest prices, being reliable within the marketplace, comfort and service and frequency.

It is noted that low-cost companies concentrate on this first critical success factor by trying to offer the lowest prices. Although Ryanair has eliminated extras such as in-flight meals, advanced seat assignment, free drinks and other services, it still prioritises features which remain important to its target market. Such features include frequent departures, advance reservations, baggage handling and consistent on-time services.

Cost Reduction Strategy

To achieve its goal of having a competitive position in the airline market, Ryanair uses a cost reduction strategy. Such cost reduction strategy relies on five main aspects like fleet commonality, contracting out services, airport charges and route policies, managed staff costs and productivity and managed marketing costs. In terms of fleet commonality, the company used only one kind of plane which limits the cost for staff training, maintenance services and facility of obtaining spares, facility in scheduling aircraft and crew assignment. With their purchase of aircraft Boeing 737, Ryanair has been able to gain capacity and reduces the average age of fleet which means savings on maintenance costs and avoiding the fit of European Union-conform equipment on old feet.

The next factor under the cost reduction strategy of Ryanair is contracting out services. In this manner, aircraft handling, ticketing, handling and other functions are contracted out by Ryanair to third parties. In addition, in order to limit their expenses, engine and heavy maintenance are also contracted out whereas the staff of Ryanair carries out routine maintenance.

Another factor for the cost reduction strategy of the company is in terms of airport charges and route policies. Herein, Ryanair has made judicious choice of dealing with secondary and regional airports, where the traffic is not jammed and fees incomparably lower. Since Ryanair, is a true windfall for such airports, the airline company has a bargaining power which enables it getting favourable access fees. In addition, Ryanair provides only a point-to-point service, thus, it has no cost concerning connecting passengers. Moreover, the company pays special focus to on-time departures because it means maximising aircraft utilisation.

Managing staff costs and productivity is another factor used for reducing the cost for Ryanair. In this manner, the company pays its staff on modest salary but has set up a performance related pay structure which urges employees to

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maximise the number of sectors flown daily. This way, Ryanair both controls productivity and keeps staff costs down. Lastly, managing marketing costs is another factor that makes the company reduces it costs. Ryanair advertises mainly on it website with its logo “Ryanair.com, the Low-Fare Airline”. In addition, it is also advertised in national and regional Irish and UK newspaper, on radio and on television.

Porter’s Generic Strategy

Aside from it cost-reduction strategy, Ryan has also been able to use Porter’s generic strategies to position itself in the marketplace. Accordingly, a company positions itself by leveraging its strengths. Today, more and more people and organization are striving to be recognized in the business arena. With this objective, these organizations had been able to competently and effectively adapt to the situation in the market place by using generic strategies that enhanced their competitiveness. There are five different generic strategies that a business can choose.

These include cost leadership, differentiation, focused cost leadership and integrated cost leadership/differentiation. Each generic strategy helps the company to establish and exploit a competitive advantage within a particular competitive scope (2003). By applying these strengths, three generic strategies resulted: cost leadership, differentiation and focus (1997). The strategies used by the company include cost leadership, differentiation strategy and focused differentiation.

Cost leadership strategy is based upon a business organising and managing its value-adding activities so as to be the lowest cost producer of a product within an industry (2002). Cost advantage may be achieved in terms of how products or services are designed or in terms of its quality. Differentiation strategy is based upon persuading customers that a product is superior to that offered by competitors (2002). The value added by the uniqueness of the product or services may allow the company to charge a premium price for it. However, the danger associated with differentiation may include imitation by competitors and changes in customer tastes.

Focus differentiation strategy is aimed at a segment of the market for a product rather than at the whole market or many markets (2002). The successful way using focus strategy is to tailor product or service development strengths to a relatively narrow market segment that they know very well. The risk may include imitation and changes in the target segments. In the case of Ryanair, these three generic strategies had been utilised. First, the company offers the lowest cost of fare than its competitors in the airline. On the other hand, Ryanair has also become a focuser because it concentrated on a narrow customer segment which includes Irish and UK business people or travellers who could not afford to fly major airlines.

The main goal of the company is to provide a no frills service with low fares designed to stimulate demand. At the time, it did not aim to offer the lowest fare on the market. However, the company expanded to continental Europe and had to focus on critical success factors to survive. Nowadays, it can be said that Ryanair has shifted generic strategies to become more of a cost-leader not only in terms of passenger volumes but being the lowest cost operator in the airline industry.

Ryanair has restyled itself and shifted from a full service conventional airline to the first European low fares, no frills carrier. In 1985, it provided scheduled passenger airline services between Ireland and the UK. By the end of 1990 and despite a growth in passenger volume, the company had experienced some trouble and had to dispose off five chief executives, recording losses of IR£20 million. Ryanair had to fight to survive and the new management team, headed by Michael O'Leary, decided to restyle the company on the model of successful American Southwest Airlines.

Indeed, when one considers Porter's original framework, Ryanair's generic strategy used to be unclear: it situated itself somewhere between a cost leader and a focuser, although we can consider it was closer to a focuser. The problem with such niche strategies is that they involve a number of risks, the most obvious being that the niche can get saturated and competitors invade the segment. As long as Ryanair was the only European no frills airline, it did not have to distinctly define its strategic position. It used to try and mix focus and cost leadership and was muzzy about which one it wanted. But as soon as competitors started blooming, it had to decide which strategy it would stick to. He decided to ruthlessly pursue cost leadership. This strategy was a success and by 1997, Ryanair was floated on the Dublin Stock Exchange and on NASDAQ.

Expansion strategy is another factor that enables Ryanair to position itself in the marketplace. The company has been known to be an airline which launches new routes since its operation begins. In addition, under the expansion strategy, the company acquired Buzz in February 26, 2003. Such acquisition enables Ryanair to gain immediate access to11 new French regional airports and makes the company the largest airline operating at London Stansted Airport. In addition, the company continues to expand by opening two new Continental European bases with low-fare flights from Milan Bergamo and Stockholm. In the year 2003, the company was able to launch 73 new routes and carry over 2 million passengers in one month (July). In addition, the company website has been able to make the company position itself in the global market.

Strategic Options

The case study has provided the problems and issues encountered by Ryanair, inspite of its strategies. One of the problems is in terms of handling customers

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or target market. In addition, another problem is assuring quality service. In this manner, the strategic option that can be used by the company for satisfying both internal and external customers and marketing environment is the use of total quality management. The industrial competitors in the airline industry worldwide are at risk, making companies in this field across the globe search for extensive strategic management procedures that would keep them in the business world. The tasks of crafting, implementing, and executing company strategies are the heart and soul of managing business enterprises. A company's strategy serves as the gameplan management and is used to stake out a market position, conduct its operations, attract and please customers, compete successfully, and achieve organizational objectives. Thus, TQM as a strategy is certainly appropriate for such situations.

Total Quality Management is a philosophy of management that is driven by the constant attainment of customer satisfaction though the continuous improvement of all organizational processes (1998). It is a management philosophy that seeks to integrate all organizational functions such as marketing, finance, design, engineering, production, customer service, and others to focus on meeting customer needs and organizational objectives (2000).

It is known that every organization's primary purpose is to stay in business, so that it can promote the stability of the community, generate products and services that are useful to customers, and provide setting for the satisfaction and growth of organization members. From this perspective, it can be said that TQM strategy for achieving its normative outcomes is rooted in four interlocked assumptions: quality, people, organizations, and the role of the senior management (1995).

Total Quality Management is a planned procedure for satisfying internal and external customers and suppliers by integrating the business environment, continuous improvement, and come through with advancement, growth, and safeguarding the cycles while changing organisational culture. Furthermore, TQM is an array of management system throughout the organisation, geared to ensure that the organisation continuously attains or surpasses customer requirements. TQM places strong focus on process measurement and controls as means of continuous improvement (1999). Moreover, Total Quality Management is infinitely variable and adaptable. Although originally applied to manufacturing operations, and over the years only used in that area, TQM is now being recognised as a standard management instrument, just as applicable in service and public sector organisations like the airlines industries (2004).

The Total Quality Management (TQM) philosophy of management is customer-oriented. Hence, the airline operations must be developed in order to steadily deal with the improvement of their operation through the ongoing

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participation of all employees in problem solving efforts across functional and hierarchical boundaries. TQM incorporates the concepts of service quality, process management, quality assertion, and quality perfection. Consequently, the airline company must be able to control all transformation processes with regards to their operations and services to better satisfy customer needs in the most economical way.

In order to apply the TQM to Ryanair especially to be used in its airline operations and services, the management of the airline company must be able to accept the whole concept of the improvement, which means that all the people of the airline company must agree that there is a need for a total transformation especially for the quality of operations and services that the industry will be offered. Furthermore, the management should be willing to participate to all the improvement, value each and every one's opinion in order to achieve total quality management and provide total quality operations and services to satisfy their customers. Managers and experts disagree about how to effectively implement Total Quality Management to their organisations.

Eventually, customer satisfaction has always been regarded as the driving force behind quality improvement; others suggest quality management is achieved by internal productivity or cost improvement programs. In other applications, Total Quality Management is regarded as a technique to introduce the context of participative type of management (1998). Thus, the management should be more straightforward to provide the potential role of applying the Total Quality Management to their operations and services.

In addition, since Total Quality Management is based on internal or self-control, which is embedded in every element of the work system (technology and people), the employees or the people behind the operation and services being offered to the passengers and customers of the airline must be able to determine the problems beforehand, to anticipate its occurrences.

Pushing problem solving and decision-making down in Ryanair especially to their operations and services may allow people who do the work to both assess and take remedial action in order to deliver an operation or service that meets the needs of their customer. In applying total quality management to airline operations, they must be able to combine it with the core strategy of the industries; this does not mean that such airline companies must have total changes. It is important that in application of the Total Quality Management to the Ryanair operations and services they must also consider that an appropriate strategy should be used in order to employ total quality operations and services that would satisfy all clients and customers.

Source: *Scribd.com*

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5.12 SUMMARY

- Total Quality Management (TQM) is a management philosophy that seeks to guide the operation of the entire organization. It typically requires every person in the organization to be focused on the customer and the service or product that the customer receives.
- TQM is a management approach in which quality is emphasized in every aspect of the business and organization.
- TQM has been coined to describe a philosophy that makes quality the driving force behind leadership, design, planning, and improvement initiatives. For this, TQM requires the help of those eight key elements. These elements can be divided into four groups according to their function.
- The principles of Total Quality Management (TQM) are now a recognized characteristic of most of successful businesses the world over. Customers' changing demands, the awesome penetration of Japan (Asian Lion) and its Pacific Rim neighbors, viz, South Korea, Taiwan, Singapore and Hong Kong (called Asian Tigers) into the US and western markets and the need for stringent cost management in a fluctuating environment, make TQM a practice of paramount importance for every enterprise, big or small.
- Benchmarking is a strategy that is often employed to assess the level of overall performance of a company operating within a specific industry.
- Business Process Reengineering is an approach to the positioning of a business enterprise by essentially redesigning the structure of the business from the ground up.
- Standards crystallize past experience and knowledge. It would be no exaggeration to say that industrial production efficiency depends on the number of effective standards set and utilized. However, some people believe that standards are enslaving and stifle creativity.
- The ISO 9000 originated from the quality standards of the US Department of Defense. The British Standards Institution (BSI) adopted the Department of Defense standards and expanded it to include the whole business process.
- The ISO 14000 family addresses various aspects of environmental management. It provides practical tools for companies and organizations looking to identify and control their environmental impact and constantly improve their environmental performance.
- A quality manual is a document stating the quality policy and describing the quality system of an organization (ISO 8402, 1994).
- The implementation of TQM in business organisations provides an opportunity to update and enhance the abilities of the staff to work effectively, yet it is still not free from some barriers.

Check Your Progress

Fill in the Blanks

5. The process of ……… helps a business to have an idea of its overall standing within the community, and make it possible to identify areas where there is room for improvement.
6. The architects of ………… are Michael Hammer and James Champy.
7. ………….. involves modeling workflow and information requirement, of new business processes.
8. A …………… is a document stating the quality policy and describing the quality system of an organization.

5.13 KEY TERMS

- **Total quality management (TQM):** Total quality management (TQM) is a management philosophy that seeks to guide the operation of the entire organization.
- **Ethics:** Ethics is the discipline concerned with the good and the bad in any situation. It is a subject represented by organizational and individual ethics.
- **Integrity:** Integrity implies honesty, morals, values, fairness, and adherence to the facts and sincerity.
- **Recognition:** Recognition is the last and final element in the entire system. It should be provided for both suggestions and achievements for teams as well as individuals.
- **Benchmarking:** Benchmarking is a strategy that is often employed to assess the level of overall performance of a company operating within a specific industry.
- **Business Process Reengineering:** Business Process Reengineering is an approach to the positioning of a business enterprise by essentially redesigning the structure of the business from the ground up.

5.14 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Total Quality Management (TQM) is a management philosophy that seeks to guide the operation of the entire organization. It typically requires every person in the organization to be focused on the customer and the service or product that the customer receives.
2. Integrity implies honesty, morals, values, fairness, and adherence to the facts and sincerity.
3. These are temporary teams to solve certain problems and also to identify and overcome causes of problems. They generally last from one week to three months.
4. Communication means a common understanding of ideas between the sender and the receiver.
5. Benchmarking.
6. Business Process Reengineering.
7. Blueprinting.
8. Quality manual.

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5.15 QUESTIONS AND EXERCISES

Short Answer Questions

1. Define Total Quality Management.
2. What are the key foundation elements of Total Quality Management?
3. What do you mean by global benchmarking?
4. Define leadership.
5. What are the different types of teams?
6. Define communication.
7. What are the different types of communication?

Long Answer Questions

1. What are the key elements of Total Quality Management? Discuss.
2. Discuss the concept of Total Quality Management from a global perspective.
3. Define global standards. What is the ISO 9000 series?
4. Discuss the nature and scope of QS 14000.
5. Discuss the meaning and importance of quality manual.
6. What are the key barriers of Total Quality Management?

UNIT 6 TOTAL QUALITY MANAGEMENT AND LEADERSHIP

Structure

6.0 INTRODUCTION

Leadership has been a key topic of research and practical interest for a number of decades. Research on leadership has taken a number of different perspectives such as the trait approach, the behavioural approach, the contingency approach, and the charismatic approach (House & Aditya, 1997; Yukl, 2002). Despite their implications for the management of quality in organizations, these theories have not explicitly focused on quality and on the role of leaders as managers of quality. Much of the theory and research frameworks developed focus on leadership as a key managerial role. Within this framework of viewing leadership as a key managerial role, leaders have been seen as people managers, task managers, communicators, inspirers, and information processors, but not as managers of quality. This study contributes to the literature by examining both the traits and behaviours of leaders as quality managers.

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6.1 UNIT OBJECTIVES

After studying this unit, you will be able to:

- Describe the key aspects of implementing TQM
- Discuss the key phases of TQM implementation
- Identify the key quality awards.

6.2 TOTAL QUALITY MANAGEMENT AND LEADERSHIP

Leadership behaviours lead to highly motivated staff. Subordinates rely upon the leadership skills of their superiors to show them how to achieve their needs of motivation, rewards and ability to perform their allocated tasks. Leaders resolve interpersonal differences. Formal systems are simplified and attempts are made to create a more open, reactive organizational environment. The need for leadership qualities turns more towards the ability to get people to interact. The capacity to mediate is very important, and the ability to plan and analyse feedback is emphasized. The leader's role is not diminished but it is changed in its nature. Participative leadership involves employee participation in management. Subordinates are consulted for their opinions as part of the decision-making process.

Defining Leadership

Leadership is the ability to inspire confidence and support among those needed to achieve organizational goals (DuBrin, 1995). Anderson et al. (1994a) explained the concept of leadership as: The ability of top management to establish, practice, and lead a long-term vision for the firm, driven by changing customer requirements, as opposed to an internal management control role. Leadership is thus exemplified by clarity of vision, long-term orientation, coaching management style, participative change, employee empowerment, and planning and implementing organizational change. According to Juran and Gryna (1993), certain roles of top management can be identified as: Establish quality policies, establish and deploy quality goals, provide resources, provide problem-oriented training, and stimulate improvement. The European Quality Award (1994) and the Malcolm Baldrige Quality Award (1999) recognize the crucial role of leadership in creating the goals, values and systems that guide the pursuit of continuous performance improvement. Recognition of the critical role of leadership and its responsibility in pursuit of continuous quality improvement echoes the arguments put forward by quality gurus such as Deming (1986), Juran (Juran and Gryna, 1993), and Crosby (1979). Thus, the concept of leadership in this study can be defined as the ability of top management to lead the firm in continuously pursuing long-term overall business success. This is exemplified by top management participation, top management encouragement, employee empowerment, top management learning, top management commitment to employee

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education and training, and top management pursuit of product quality and long-term business success. A predominant theme in quality management literature is that strong commitment from top management is vital. The foundation of an effective leadership effort is top commitment. Demonstrating such commitment is therefore a primary leadership principle for achieving TQM. Lack of top management commitment is one of the reasons for the failure of TQM efforts (Brown et al., 1994). However, top management commitment itself is not sufficient. It is more important that top management personally participates in various quality management activities. Furthermore, it should strongly encourage employee involvement in quality management activities. According to DuBrin (1995), an important leadership practice is to encourage people to assess the level of quality. To be an effective leader in most modern firms, the top manager must continue to develop and learn. Knowledge of the business and continual learning are essential prerequisites to effective leadership (DuBrin, 1995). The extensive literature review by Anderson et al. (1994a) suggested that if leadership wants to create organizational cultures that will themselves be more amenable to learning, they must set the example by becoming learners themselves and involving others in the learning process. Thus, a learning organization will be established.

Total Quality Management Leadership

Total Quality Management (TQM) leadership refers to top managers of an organization responsible for implementing a system to improve customer satisfaction. The Total Quality Management philosophy starts with company owners and high-ranking managers committed to getting work done right the first time. It's a process that includes developing a plan to improve delivery of products or services, and implementing that plan throughout the organization.

Managers charged with total quality management leadership put the customer at the center of a system so every interaction occurs in a reliable and timely manner. The main concept communicated throughout the company hinges on meeting customer expectations every time. Meeting these goals might give the company an edge over competitors, eliminate the cost of correcting mistakes, and increase productivity.

To be effective in total quality management leadership, managers typically write a mission statement outlining the principles, values, and beliefs of the organization. They ensure the mission statement is shared and understood by every person employed in the firm. Leaders also develop strategies for implementing plans to improve customer relations and explain these techniques to lower-level supervisors.

One factor that determines total quality manager leadership effectiveness centers on the ability to gain acceptance of these principles from all employees. Senior managers who serve as good role models for subordinates might see more success in motivating others to embrace a TQM system. They are responsible for ensuring that every employee embraces the concept and commits to change.

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Educating and training employees represents another facet of total quality management leadership duties. Managers typically provide resources and tools to help staff members reduce the number of errors in their work. This training might change attitudes that accept errors as part of doing business into a culture of striving for excellence. Training might foster pride in the workplace, leading to zero tolerance for mistakes throughout the company and a sense of teamwork.

The total quality management leadership team also monitors the process and makes adjustments as needed. Managers periodically evaluate the success of the plan to learn what works and what needs improvement. When changes become necessary, leaders make sure communication remains open to allow employees time to adapt.

Some companies employ total quality management principles when working with suppliers. Interactions with suppliers of goods needed to produce the final product might ultimately affect customer satisfaction. Using suppliers who understand and buy into TQM concepts might help reduce waste and lost time. Firms might also obtain supplies in a more cost-effective way.

Empowerment is the process of delegating decision-making authority to lower levels within the firm. Particularly dramatic is empowerment of the workforce (Juran and Gryna, 1993), which is valuable because it may release creative energy (DuBrin, 1995). In order to effectively lead the firm, top management must empower employees to solve the problems they encounter. Thus, employees can have the authority to fix problems and prevent their further occurrence.

In order to effectively lead the firm, top management must be committed to providing sufficient resources for employees' education and training, building trustful relationships with employees, and regarding them as valuable resources of the firm. Top management must be committed to allocating sufficient resources to prevent, as well as repair, quality problems. Top management should discuss quality frequently; for example, by giving speeches on the topic and asking questions about quality at every staff meeting. In fact, people make things happen. Therefore, top management must train and coach employees to access, analyze, and improve work processes (Dale and Plunkett, 1990; Deming, 1986).

The study conducted by Garvin (1986) suggested that high levels of quality performance were always accompanied by an organizational commitment to that goal; high product quality did not exist without strong top management commitment. Many such empirical studies have also found that top management support for quality was a key factor in quality improvement. Therefore, it is essential that top management focuses on product quality rather than yields alone. More importantly, it is critical for the firm to pursue long-term business success. Pursuing short-term business success places quality behind yield, costs, and meeting delivery schedules, according to this study's author.

TQM Implementation and Leadership

Top Management Commitment

Top management commitment is the first step and a prerequisite for a firm's TQM implementation efforts. Lack of management commitment is one of the reasons for the failure of TQM efforts (Brown et al., 1994). Top managers need to demonstrate their commitment through their actions rather than words. Top management commitment can positively affect employees' commitment to TQM and culturally change the people involved. If top management views quality as more important than cost, more important than meeting product schedules, employees' quality awareness is easily improved. To implement TQM, top managers should be committed to establishing a firm that continually views quality as a primary goal. If the organizational culture does not embody quality, any quality improvement effort is probably shallow and short-lived (Dale, 1999; Juran and Gryna, 1993).

Top Management Participation

It is very difficult to improve product quality and quality management if top managers do not lead and participate. Quality improvement involves making decisions and creates something that did not exist before. It is not sufficient for top managers to stand on the sidelines and shout "improve product quality and intensify quality management". There is no way that a manufacturing firm can implement quality improvement activities if the top managers are bystanders. Particularly in a firm with an autocratic general manager, there is a strong trend that employees act on something only in proportion to the manager's degree of interest. Top management participation is crucial to a firm's quality improvement efforts; it obviously helps in spreading quality consciousness throughout a firm (Dale, 1999; Ikezawa, 1993).

Top Management Learning

Top managers need to improve their managerial abilities through continuous learning. To implement TQM, they must first know what it is. Learning TQM is an important step toward implementing it. Top managers should be modest enough to learn from their employees and value the ability of their creativity. Top managers also need to learn from other organizations' successful and unsuccessful experiences, as well as modern management methods from foreign firms. Above all, top managers should combine these insights into an approach that fits the specific conditions, problems, and challenges of their own firms. Through top management learning, a learning organization can be established. Finally, the effectiveness of leadership can be improved and the ability of decision-making enhanced (Anderson et al., 1994a; Bergman and Klefsjö, 1994; Dale, 1999; Ikezawa, 1993; Juran and Gryna, 1993).

Top Management Empowerment

Empowerment means giving permission to the workforce to unleash, develop, and utilize their skills and knowledge to their fullest potential for the firm. Empowerment

has many benefits such as increasing employees' motivation to reduce mistakes, increasing the opportunity for creativity and innovation, improving employee loyalty, and allowing top and middle management more time for strategic planning. It is necessary to utilize the strategy of moving toward more humanistic management as the specific objective of improving quality management. The masses have boundless creative power. Top management needs to empower employees to solve various problems and should rely on employees wholeheartedly (DuBrin, 1995; Juran and Gryna, 1993; Kolarik, 1995).

Top Management Encouragement

Top managers should strongly encourage employee involvement in quality management and improvement activities, attach great importance to employees' suggestions, take responsibility for employees' actions as well as those of the people who report to them, and be open and willing to listen to the voices of employees. When TQM is implemented, top managers must have more enthusiasm than their employees. This enthusiasm should be demonstrated by a positive attitude, especially when employees are unwilling. Top managers should trust employees and believe that they can do things better, as well as encourage them to list the firm's shortcomings and report their own working problems. Such employees should be praised instead of criticized. Top managers should implement TQM, adopting a humanistic approach that considers the value of human existence in a new age (Ikezawa, 1993; Kolarik, 1995).

Top Management's Role Model

Top managers need to act as role models, leading by example. A Chinese proverb states "Example is better than precept". Employees always look to top managers for a standard of correct behavior. The manner in which top managers conduct themselves is more influential than any instructions they may give or any discipline they may impose. Any infringement upon the firm's rules and values can negatively affect employees' satisfaction and commitment. It is vital that top managers handle matters impartially and set an example for their employees to follow. Their model role can positively affect employees' commitment, satisfaction, participation, confidence, initiatives, and creativity (obtained from the ten interviews).

Pursuit of Long-Term Business Success

Top managers should pursue long-term business success instead of short-term benefits. They should focus on product quality rather than yields. Hasty pursuit of short-term profits, short-term sales, and short-term production often results in quality being relegated to third place behind concerns for costs and delivery time. TQM requires long-term commitment and endurance; there are no quick fixes. TQM implementation requires investment. In return, it can lead to an impressive increase of overall business performance. However, the findings from the ten interviewed

firms showed that there are no simple ways to gear the profits. Only after much effort and commitment were the firms able to see the effects of their TQM implementation efforts. Top management must realize that improvement takes time. Things can be improved as TQM implementation continues (obtained from the ten interviews).

Management by Fact

One of the most important jobs of top management is to make decisions. It is impossible to make good decisions without suitable information; it is extremely important to have a decision-supporting information system to assist managers in making decisions. It is also vital to have an information system that can provide past, present, and future information appropriate for planning, organizing, and controlling the operations of a functional area in the firm. For example, a firm wants to improve its product quality. It must make decisions and determine what actions should be taken. Note that 'take actions' means to dig out the real causes of defects, to trace them all the way to their origins, and to prevent their recurrence. Generally, symptoms and causes need to be distinguished. To dig out causes requires fact-finding. Real causes cannot be guessed, thus there is a definite need to observe the facts carefully. It is important to know that data show symptoms rather than real causes. Therefore, it is essential to manage a firm by fact rather than by imagination (Bergman and Klefsjö, 1994; Ikezawa, 1993).

Implementing TQM

Total Quality Management (TQM) as a management tool needs to radically rethink the way in which an organization is organised and performs its functions. With its emphasis on meeting users' needs, TQM is seen as a commitment to service with a flexible and future-oriented approach to management. A preliminary step in TQM implementation is to assess the organization's current reality. Relevant preconditions have to do with the organization's history, its current needs, precipitating events leading to TQM, and the existing employee quality of working life. If the current reality does not include important preconditions, TQM implementation should be delayed until the organization is in a state in which TQM is likely to succeed.

If an organization has a track record of effective responsiveness to the environment, and if it has been able to successfully change the way it operates when needed, TQM will be easier to implement. If an organization has been historically reactive and has no skill at improving its operating systems, there will be both employee skepticism and a lack of skilled change agents. If this condition prevails, a comprehensive program of management and leadership development may be instituted. A management audit is a good assessment tool to identify current levels of organizational functioning and areas in need of change. An organization should be basically healthy before beginning TQM. If it has significant problems such as a very unstable funding base, weak administrative systems, lack of managerial skill, or poor employee morale, TQM would not be appropriate.

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However, a certain level of stress is probably desirable to initiate TQM. People need to feel a need for a change. Kanter (1983) addresses this phenomenon by describing building blocks which are present in effective organizational change. These forces include departures from tradition, a crisis or galvanizing event, strategic decisions, individual "prime movers," and action vehicles. Departures from tradition are activities, usually at lower levels of the organization, which occur when entrepreneurs move outside the normal ways of operating to solve a problem. A crisis, if it is not too disabling, can also help create a sense of urgency which can mobilize people to act. In the case of TQM, this may be a funding cut or threat, or demands from consumers or other stakeholders for improved quality of service. After a crisis, a leader may intervene strategically by articulating a new vision of the future to help the organization deal with it. A plan to implement TQM may be such a strategic decision. Such a leader may then become a prime mover, who takes charge in championing the new idea and showing others how it will help them get where they want to go. Finally, action vehicles are needed and mechanisms or structures to enable the change to occur and become institutionalized.

6.2.1 Essentials of TQM Implementation

Implementing total quality management (TQM) is best done as a revamping or overhaul of the culture of a business. This is so the focus becomes having everyone involved in making decisions that will improve the quality of products and services. While implementing total quality management, every person employed by the organization — including executives, managers, supervisors and non-management employees — should be given a chance to see how this system can help improve all aspects of their work. TQM, although typically instituted in businesses, also can be used in other settings, such as in schools and nonprofit organizations.

One important aspect involved in implementing total quality management is helping all members of the team see that they have a vital role in ensuring that the quality of services and products delivered is as high as possible. This includes everyone from the chief executive officer of the company down to part-time workers. When all people understand they are an integral part of the overall quality of the organization and feel their input is valued, they will likely work harder to ensure that they live up to the responsibility and trust that has been bestowed on them.

Businesses and other organizations that decide on implementing total quality management need to understand that things may change because it is a solutions-oriented system. Whatever the focus was before, the idea now is to focus on finding real solutions to problems. If orders are being shipped late, for example, a solution might be found to resolve delays in the production department, which might be behind because of having to wait for a certain vendor to deliver needed materials. Solving the problem with the vendor should help fix the entire problem, whereas before the implementation of TQM, all of the blame might have fallen on the shipping department.

TQM also is a measurement-oriented and goal-oriented long-term system. Businesses using this type of management plan must be devoted to the continuous setting and evaluation of goals, especially those that can be quantified. The assessment of quality under total quality management happens year-round. Even employee assessments, which often are a relatively meaningless annual event with general assessments and seldom-examined goals, become regular parts of the professional lives of employees, who are challenged to improve and to meet measurable goals set by them and their supervisors. When total quality management is implemented effectively, all members of the business or organization should stay focused on continuous improvement.

6.2.2 Guidelines for Effective TQM Implementation

Implementing total quality management (TQM) is best done as a revamping or overhaul of the culture of a business. This is so the focus becomes having everyone involved in making decisions that will improve the quality of products and services. While implementing total quality management, every person employed by the organization — including executives, managers, supervisors and non-management employees — should be given a chance to see how this system can help improve all aspects of their work. TQM, although typically instituted in businesses, also can be used in other settings, such as in schools and non-profit organizations.

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lives of employees, who are challenged to improve and to meet measurable goals set by them and their supervisors. When total quality management is implemented effectively, all members of the business or organization should stay focused on continuous improvement.

6.2.3 Approaches to TQM Implementation

The following are the key approaches to TQM implementation:

Integrated Management Approach

In this approach, the principles of TQM are blended and balanced with existing practices in both organizational and human resource (employee) management systems. The management asks for a third party assistance, who is an expert in the field, in order to establish TQM in the company. This approach represents the 20% success rate of TQMs. It is divided into two sub-choices, depending upon managerial resources, readiness, acceptance, and competencies. In both sub-choices one and two, TQM finds a way to blend both bottom-line organizational realities with individual human realities into a unique set of quality beliefs and actions.

- TQM can be approached as a concept of management that adjusts and restores management in producing end products or services resulting in customer satisfaction. In this case, management and individuals of the organization are usually operating fairly effectively and the culture is supportive of accepting innovation. In such a scenario, TQM becomes the "accepted advantage" in beating competition for gaining customers, loyalties etc. Thus, successful TQM implementation can be done internally without much external help.
- TQM can also be approached as a system of management that provides processes and competencies currently lacking and needed by management. Some of the basic areas include decision-making and traditional areas of measurement. In these cases, companies benefit from well-designed "TQM Initiatives" that have the external power for changing culture to a supportive role. The TQM's role in this instance is much greater, as it must enlighten the individuals and systems in the organization in areas essential to healthy TQM.

Traditional Management Approach

This is the most common approach, and is also the cause of most of the failures. It involves overlaying (or forcing) of TQM system (s) and processes onto (or into) existing cultures without negotiating with or gaining commitment to their impact on individual's lives. The management sees TQM as a technical process only. As usual, a third party expert group is called for making the change. Since these groups are expensive to employ, the companies try to extract maximum benefit within a limited period. In most cases, the employees are subjected to a series of training lectures. This quick spell on TQM aims to change the behaviour of employees but does not aim for a cultural change that supports the behaviour change. In fact, with

proper guidance and training, it is possible to change attitudes of employees within weeks and months. However, sustainable culture change takes a minimum of three years before total impact is seen. The consequence of such a limited focus is that employees tolerate the changes in the initial period, but as there is no real agenda of what change to bring into the personal lives of employees or the health of the organization, it remains a concept. When money runs out or a new idea comes along the company quickly abandons this concept too.

6.2.4 Barriers in TQM Implementation

A brief outline of problems in implementing TQM is given below:

- Lack of formal strategy
- Failure to provide incentive by recognition
- Lack of effective communication
- Narrowly based training
- Lack of faith in and support of TQM, activities among management personnel
- Lack of interest and incompetent leadership
- Misunderstanding the concept of TQM
- Delay or non-implementation of quality improvement team recommendations
- Irregularity of team meetings
- Non-application of proper techniques
- Inadequate visibility of top management support

The following issues are pertinent in TQM analysis.

- The activities involved in the process
- Identification of major problems
- Inquiring into the causes
- Reviewing past experiences
- Discovering the cause effect relationships
- Current status of the activity as revealed through data.

In the following sections you will study the key steps involved in TQM implementation.

6.3 MARKET CHOICES

The customer defines the purpose of the organization and every process within it. Success means striving to become the best supplier of your particular products and services in the minds of those customers. To achieve that success, your organization

must align its overriding strategic vision with a vision of customer service and satisfaction. Ultimately, you will ensure all organizational purposes aim at meeting your customers' needs and you will monitor your organization's performance to ensure this performance is maintained and improved. This approach to customer service applies to each organizational process with respect to its internal customers as well.

Who are the external and internal customers? Can customers be segmented either on the basis of the service that they require, or their attitudes to effective service delivery? This will no doubt bring out different opinions from different groups. As a starting point, organisations should focus their efforts on identifying the customers and determining their expectations. The objective is to provide excellent service to existing customers. Satisfied customers bring new customers, dissatisfied customers discourage new and existing customers. Of course improved customer service and satisfaction is a long-term strategic initiative. It requires commitment from the head of the organization, staff, funds and time. Identification of customers and providing customer service and satisfaction work as effective management tools to help business organisations to accomplish their mission.

6.4 MEETING CUSTOMER REQUIREMENTS

To measure customer satisfaction, businesses can conduct customer surveys, hold focus groups, and sign up advisory groups. A survey can cover elements of the customer experience, including their ratings of the quality and speed of delivery of the product or service and the pricing, problems they've experienced or complaints they have, other types of service or products that they require, and the degree to which they trust the business. Focus groups allow for more in-depth discussion, and can facilitate the presentation of new product or service concepts for reaction on a one-time basis. Client advisory groups have an ongoing relationship with a business. In addition, comment cards offer customers an opportunity to sound off whenever they have something on their minds, and this may allow for positive responses to be recorded that would otherwise be lost.

To ensure customer satisfaction, experts recommend prompt response to customer communications, whether by phone, mail, email, or Twitter. They suggest that employees maintain a friendly and approachable air and demeanor. It is important to have a clear and detailed customer service policy that is publicly available and to offer the customer an apology and correction when something goes wrong. Clear and straightforward shipping and return policies are also helpful, as is carrying out all promises and implied promises of those policies. In addition, performing over and above promises to help consumers who are in need of further assistance can help turn customers into company evangelists.

The following points should be followed for effective customer satisfaction:

1. Link Organizational Purpose to Customer Satisfaction

The customer defines the purpose of the organization and every process within it. Success means striving to become the best supplier of your particular products and services in the minds of those customers. To achieve that success, your organization must align its overriding strategic vision with a vision of customer service and satisfaction. Ultimately, you will ensure all organizational purposes aim at meeting your customers' needs and you will monitor your organization's performance to ensure this performance is maintained and improved. This approach to customer service applies to each organizational process with respect to its internal customers as well.

2. Identify External and Internal Customers

Identifying your customers is the first step in developing a customer focus. External customers can be easier to identify; they are outside your organization, and usually have formal relationships with your organization. Your internal customers are another matter. You must carefully assess your own processes and determine who in the organization receives their output and benefits from them. Who should benefit from them? These are your internal customers. Once you identify your customers, you should ensure they understand they are your customers.

3. Understanding Customer needs, Expectations and Requirements

Satisfying your customers means that the products and services your processes generate meet your customers' needs. To ensure your processes meet those needs, you must first understand what the needs are. Your customers will have specific requirements that are peculiar to their own operations and concerns. They will expect a certain level of performance from you and from your products. They may also have implicit needs that they do not articulate but that are equally important. As a supplier, you have a responsibility to ensure that these customer needs, requirements, and expectations are communicated and that they are mutually understood and agreed upon.

4. Establish Routine and Meaningful Dialogue with Customers

Continuous, ongoing discussion of your customers' needs and how well you are meeting those needs is crucial to effective customer service. Customer needs are always changing as are your environment and the customer's environment. You must continually update your understanding of customer requirements in the context of a dynamic environment if you wish your products and services to be most useful to your customers. You must also communicate your own needs for information and feedback to your customers. Help them understand your processes and how their requests and timing affect your ability to be a good supplier.

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5. Listen to the Customer

More important than merely talking to your customers is listening to your customers. You can only discover what your customers' true needs are by listening to and watching them. If possible, have them take you to their work areas and show you how they use your products and services. You will bring your own biases and preferences to any discussions or meetings, and those preferences will affect the course of any dialogue you undertake with your customers. To ensure you adequately understand your customers' own biases and preferences, you should listen before adding your own preferences to your discussion. By listening to your customers, you will also gain improved understanding of your own performance.

6. Involve the Customer in Planning and Decision Making

Planning and decision-making can be much more effective when your customers are involved. That does not mean that they control or materially manipulate the planning process but rather that they communicate their needs in terms of your planning and strategic focus. Because they are the foundation of your goals and objectives, your customers can provide feedback and information that is beneficial to the overall planning process.

6.5 MAINTAINING COMPETITIVE ADVANTAGE

A common success theme of operations strategy lies on manufacturers' choice of emphasis among key capabilities or competitive advantages. The preferred competitive advantage guides operations development and specifies how the operations function provides a firm with competitive advantage in the marketplace or tactical goal of the operational functions (Wheelwright and Bowen, 1996; Hills, 2000; Chenhall and Langfield-Smith, 1998). Once competitive advantages are chosen, they become the basis for making operational decisions in the marketplace (Ward et al., 1995; Margaret, 1996). Manufacturing strategy literature suggests four competitive advantages: low cost, quality, delivery, and flexibility (Skinner, 1974; Van Dierdonck and Miller, 1980; Hayes and Wheelwright, 1984). The character of each competitive priority is discussed as follows:

Cost refers the production and distribution of a product or service at lowest expense. Lowering prices can increase demand for products or services, but it can also reduce profit margins if the product or service cannot be produced at a lower cost. Lowering cost can capture the competitive priority by placing an emphasis on reducing production costs and inventory while increasing equipment utilization and capacity utilization (Kathuria, 2000; Ward and Duray, 2000; Tseng and Chiu, 2004).

Garvin (1991) points out that quality are multidimensional and that each of its dimensions can be used strategically to gain competitive advantage. The quality scale

that is being used includes items related to the important quality aspect of process control and process management, specifically, high performance design on the future of superior features, close tolerance and great durability. Quality consistency refers to the frequency of meeting the design specifications.

The flexibility scale intends to capture the importance of reducing costs associated with changing products or mix. In particular, the scale measures the relative emphasis placed on the capacity for lead-time and set-up time reductions, the ability to change priority of jobs on the shopfloor, and the ability to change machine assignments on the shopfloor (Ward and Duray, 2000).

Delivery pertains to manufacturers' emphasis on customer service as indicated by either delivery reliability or delivery speed. Delivery reliability refers to the ability to meet delivery schedule or promises, whereas delivery speed refers to the ability to react quickly to customer orders (Kathuria, 2000).

6.6 CORE COMPETENCE AND STRATEGIC ALLIANCE FOR ENSURING QUALITY

The need for a strategy arises because choices are not obvious. Better quality at any price is a naïve strategy which recently turned out to be right because the cost of quality has been grossly understated and the benefits of quality entirely unaccounted for. Today it is believed that a comprehensive approach to the design and management of quality is essential to strengthen a firm's competitive position. An investment in quality must be justified by an acceptable rate of return, however. In an article on quality, Business Week (August 8, 1994) reports that theirs is an overwhelming concern that quality must pay. For example, Varian, a Silicon Valley firm, went about reinventing the way it did business with what seemed to be stunning results. A unit that makes vacuum systems for computer clean rooms boosted on-time delivery from 42% to 92%. The radiation-equipment – service department ranked number 1 in its industry for prompt customer visits. But while Varian performed extremely well according to its statistics, it did poorly in the market place. While meeting production schedules, they did not return customers phone calls. Radiation-repair people were so rushed to meet deadlines that share. Over-emphasis on statistical performance and neglect of the firm's bottom line' has recurred in many other firms, leading to myopic policies, and subsequently to losses. This has led to reassessment, and a treatment of quality as means and not and an end. A strategic approach to quality must necessarily be sensitive and comprehensive, providing value where it matters and which can be justified.

Quality can create value if it:

- Improves product's marketability or the firm's image. It contributes to repeat-purchase, and thereby to long-term profitability.

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- Provides a competitive edge. For example, entry to some markets that are well protected can in some cases be reached only through an improvement in quality.
- Meets regulated standards, such as health and security standards.
- Affect the market structure by reducing competition when it is based on differentiation and substitution. Firms with particularly high quality products can, in some market segments, act as if they were monopolists.
- Improves the social image of a firm because quality cart provide greater benefits to society and thus contributes to the firm's long-term profitability.
- Reduces the costs of servicing, of attending to defectives and dealing with customer complaints.

These effects were discussed earlier, but are extremely difficult to evaluate and quantify. To assess their true impact, it is first necessary to conduct a strategic quality audit and to assess its impact in terms of the value quality can add. Starting from a basic operational concern for the control of quality, emphasizing the control of processes, and expanding outwards to the global concerns of quality, emphasizing profitability and long-term survival. In this unit, we shall elaborate on aspects of the quality strategy, on producer-supplier relationships, as well as studying the economic approach to quality. In addition special strategic topics such as technologies and quality software systems are discussed. We shall also briefly review the economic theory approach to quality, which it is important to appreciate in order to formulate a quality strategy.

Dynamics of quality management in strategic alliances

According to institutional theory of the firm, the adoption of new administrative innovations (such as QM) is an institutional process subject to competitive and institutional effects (Yeung et al., 2006). Westphal et al. (1997) defined QM as "a managerial innovation that emphasizes an organization's commitment to the customer and to continuous improvement of every process through the use of data-driven, problem-solving approaches on empowerment of employee groups and teams." (p. 367). A social network can influence the form of practices organizations introduce. It has been argued that institutional forces affect both QM adoption and its content. Due to the institutional/network effect, firms restructure their QM practices and develop a new set of practices compatible with the new settings (Browning et al., 1995). This calls for a new QM content and process within strategic alliances (Westphal et al., 1997).

Another relevant issue that bridges QM and strategic alliances together is the role of learning in alliances (Morrison and Mezentseff, 1997). QM emphasizes learning (Hackman and Wageman, 1995; Linderman et al., 2004). As Garvin (1993) pointed out, continuous improvement would not happen until there was a learning

environment. It is believed that continuous improvement and knowledge creation are vital activities of QM (Dean and Bowen, 1994; Kolesar, 1994). A recent study by Linderman et al. (2004) demonstrates the link between QM and knowledge creation, where QM practices create knowledge and enhance organizational learning, which leads to higher performance. Regarding the overall quality of strategic alliances, Arino et al. (2001) argue that in achieving the objectives of strategic alliances, reliance on trust is not sufficient since trust is a complex issue and management should focus on a broader concept—the quality of the alliance and the critical success factors of enhancing the overall quality of the alliance. By defining relational quality as "the extent to which the partners feel comfortable and are willing to rely on trust in dealing with one another" (p. 111), they clarify that relational quality encompasses a broader concept than trust, such as degree of compatibility of corporate culture and decision-making style, and a convergence of worldviews. However, the development and evolution of relational quality as well as its relationship to the alliance performance has not been addressed in previous studies. We address this issue from the QM perspective.

Learning perspective of quality management in alliances

In the context of a network of firms, learning has been defined as the process of acquisition and exploitation of new knowledge, skills, and competencies by the organization (Argyris and Schön, 1978; Cohen and Levinthal, 1990; Muthusamy and White, 2005). While the level of learning within an alliance depends upon the absorptive capacity of partners, the success of the collective learning effort is determined by the cooperative learning among partners (Muthusamy and White, 2005). Love et al. (2002) provided a framework for strategic partnership in reference to QM. They argued that successful strategic alliance requires systems thinking, a learning culture, knowledge and communication, changing mental models, joint learning structure/process, and development of learning relationships. Through a case study (interview) with managers in the construction industry, they found that the strategic alliance resulted in improved problem-solving skills, project management performance, knowledge and competence of workers, inter-organizational relationships, and stakeholders' satisfaction. In order to benefit from knowledge and expertise of the partners in the alliances, a systematic approach to alliance learning needs to be established. Development of such a learning environment requires leadership commitment in the learning process (Inkpen, 2005).

Development of concepts and their relationships

In this section, a model for QM in strategic alliances is introduced and defined. Each element of the model is grounded with the relevant literature and evidence is provided to support its inclusion. Figure 6.1 shows the conceptual framework and the relationship between the variables.

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- **Trust:** Ring and Van de Ven (1994) defined trust as "an individual's confidence in the goodwill of the others in a given group and belief the others will make efforts consistent with the group's goal" (p. 110). Wicks (2001) argued that trust was a critical facilitator of cooperation and a vital ingredient of QM. Trust is regarded as a central prerequisite for starting any inter-organizational project and must be present from the beginning (Arnulf et al., 2005). Empirical evidence showed that employee trust in the manager was found to be significantly related to sales, profit, and employee turnover (Davis et al., 2000). Trust is generally believed to be important in the success of inter-firm relationship (Jeffries and Reed, 2000; Williams, 2007).
- **Strategic intent (direction):** Having a common strategic direction (intent) helps firms to have a better understanding of their mutual goals and expectations (Ellram, 1990). According to Lo and Yeung (2004), having a common strategic direction is a requirement for effective supplier integration in strategic alliances. Strategic intent has been regarded as an important characteristic in strategic alliances (Zollo et al., 2002). Experienced partners should recognize that changes in their strategic objectives pose a greater threat to relational quality than do most exogenous events (Arino et al., 2001).
- **Cultural compatibility:** Smith et al. (1995) argued that similarities in the partners' values contributed to the level of cooperation. It is evident that cultural closeness among firms facilitates communication between individuals, which is based upon achieving mutual understanding and trust. Zollo et al. (2002) regarded organizational culture as one of the firm-level variables in studying alliance performance.
- **Alliance governance (leadership):** Smith et al. (1995) found that leaders could play an important role in building trust within the alliance. Leaders can play an essential role in facilitating the learning process within the alliance (Inkpen, 2005), and can enhance the effectiveness of supply chain partnership (Wong, 2001). In the Baldrige Award criteria, leadership is the most important factor and has a direct impact on the effective implementation of quality systems (Wilson and Collier, 2000).
- **Process improvement:** Both practitioners and scholars recognize continuous improvement as one of the major principles of QM (Dean and Bowen, 1994; Hackman and Wageman, 1995). According to Lo and Yeung (2004), continuous improvement plays an important role in strategic alliances.
- **Cooperative learning:** Cooperative learning refers to the mechanisms through which partners can share knowledge, information, and resources. Organizations develop cooperative relationships through creating a learning environment so that they can facilitate mutual learning. Cooperative learning emphasizes

the role of cooperation in alliances, rather than competition (Morrison and Mezentseff, 1997).

- **Role clarity:** Role clarity refers to the distribution of tasks, roles, and responsibilities between companies based on each company's core competency (Prahalad and Hamel, 1989)—activities that give them competitive advantage (Porter, 1985; Stabell and Fjeldstad, 1998; Christopher, 1998; Arnulf et al., 2005).

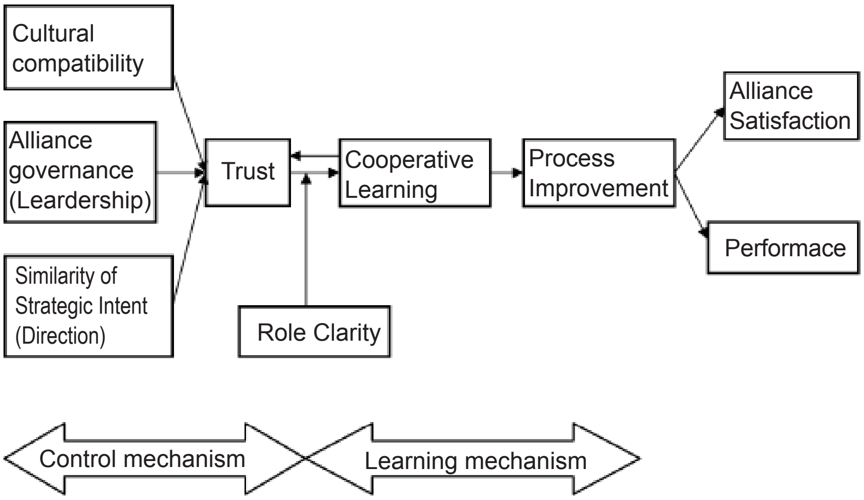


Fig. 6.1: Generic model for quality management in strategic alliances

Case Study: Improving Financial Services Through TQM

The work described in this case study was undertaken in a young, rapidly expanding company in the financial services sector with no previous experience with total quality management (TQM). The quality project began with a two-day introductory awareness program covering concepts, cases, implementation strategies and imperatives of TQM. The program was conducted for the senior management team of the company. This program used interactive exercises and real life case studies to explain the concepts of TQM and to interest them in committing resources for a demonstration project. The demonstration project, which used the seven steps of problem solving (similar to DMAIC [Define, Measure, Analyze, Improve, Control]), was to show them how TQM concepts worked in practice before they committed resources for a company-wide program.

Step 1. Define the Problem

1. **Selecting the theme:** A meeting of the senior management of the company was held. Brainstorming produced a list of more than 20 problems. The list was prioritized using the weighted average table, followed by a structured

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discussion to arrive at a consensus on the two most important themes – customer service and sales productivity.

The customer service theme, "reducing the turnaround time from an insurance proposal to policy," was selected as the most obvious and urgent problem. The company was young, and therefore had few claims to process so far. The proposal-to-policy process therefore impacted the greatest number of customers.

An appropriate cross functional group was set up to tackle this problem.

2. **Problem = customer desire – current status: Current status:** What did the individual group members think the turnaround is currently? As each member began thinking questions came up. "What type of policies do we address?" Medical policies or non-medical? The latter take longer because of the medical examination of the client required. "Between what stages do we consider turnaround?" Perceptions varied, with each person thinking about the turnaround within their department. The key process stages were mapped:

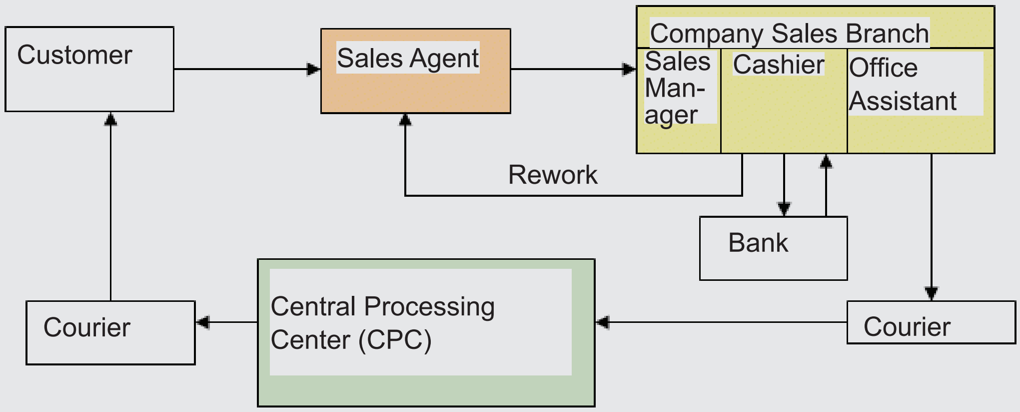


Fig. 6.2: Process Stages

Several sales branches in different parts of the country sent proposals into the central processing center (CPC). After considerable debate it was agreed at first to consider turnaround between entry into the computer system at the company sales branch and dispatch to the customer from the CPC. Later the entire cycle could be included. The perception of the length of turnaround by different members of the team was recorded. It averaged:

- Non-medical policies—17 days
- Medical policies—35 days

Invoking the slogan from the awareness program "In God we trust, the rest of us bring data," the group was asked to collect data and establish reality. Armed with a suitably designed check sheet they set about the task.

Customer desire: What was the turnaround desired by the customer? Since a customer survey was not available, individual group members were asked to

think as customers – imagine they had just given a completed proposal form to a sales agent. When would they expect the policy in hand? From the customer's point of view they realized that they did not differentiate between medical and non-medical policies. Their perception averaged out six days for the required turnaround.

"Is this the average time or maximum time that you expect?" they were asked. "Maximum," they responded. It was clear therefore that the average must be less than six days. The importance of "variability" had struck home. The concept of sigma was explained and was rapidly internalized. For 99.7 percent delivery within the customer limit the metric was defined.

Customer desire:

Average + 3 sigma turnaround = less than 6 days

Current status:

Non-medical policies (average 19/sigma 15) average + 3 sigma = 64 days

Medical (average 37/sigma 27) average + 3 sigma = 118 days

The Problem was therefore defined:

Reduce Average + 3 sigma of turnaround for:

Non-medical policies from 64 to 6 days

Medical policies from 118 to 6 days

The performance requirement appeared daunting. Therefore the initial target taken in the mission sheet (project charter) was to reduce the turnaround by 50 percent – to 32 and 59 days respectively.

Step 2. Analysis of the Problem

In a session the factors causing large turnaround times from the principles of JIT were explained. These were:

- Input arrival patterns
- Waiting times in process
    - Batching of work
    - Imbalanced processing line
    - Too many handovers
    - Non-value added activities, etc.
- Processing times
- Scheduling
- Transport times
- Deployment of manpower

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Typically it was found that waiting times constitute the bulk of processing turnaround times. Process mapping (value stream mapping in Lean) was undertaken. The aggregate results are summarized below:

Number of operations—84

Number of handovers—13

In-house processing time (estimated) 126 man-minutes

Range of individual stage time—2 to 13 minutes

Could this be true? Could the turnaround be 126 minutes for internal processing without waiting? The group started to question of the status quo. The change process had begun. To check this estimate it was decided to collect data – run two policies without waiting and record the time at each stage. The trial results amazed everyone: Policy No. 1 took 100 minutes and Policy No. 2 took 97 minutes. Almost instantly the mindset changed from doubt to desire: "Why can't we process every proposal in this way?"

Step 3. Generating Ideas

In the introductory program of TQM during the JIT session the advantages of flow versus batch processing had been dramatically demonstrated using a simple exercise. Using that background a balanced flow line was designed as follows:

1. Determine the station with the maximum time cycle which cannot be split up by reallocation – 8 minutes.
2. Balance the line to make the time taken at each stage equal 8 minutes as far as possible.
3. Reduce the stages and handovers – 13 to 8.
4. Eliminate non-value added activities – transport – make personnel sit next to each other.
5. Agree processing to be done in batch of one proposal.

Changing the mindset of the employees so they will accept and welcome change is critical to building a self-sustaining culture of improvement. In this case, the line personnel were involved in a quality-mindset program so that they understood the reasons for change and the concepts behind them and are keen to experiment with new methods of working. The line was ready for a test run.

Step 4. Testing the Idea

Testing in stages is a critical stage. It allows modification of ideas based upon practical experience and equally importantly ensures acceptance of the new methods gradually by the operating personnel.

Stage 1: Run five proposals flowing through the system and confirm results. The test produced the following results:

- Average turnaround time: < 1 day
- In-house processing time: 76 mins.

There was jubilation in the team. The productivity had increased by 24 percent. The head of the CPC summarized: "I gave five files for processing, and went for a meeting. Emerging from the meeting about 30 minutes later I was greeted by the dispatch clerk jubilantly reporting, "'Madam, the TQM files are ready for dispatch.'" The mindset was dramatically changed and line personnel were now keen to push the implementation.

Stage 2: It was agreed to run the new system for five days – and compute the average and sigma of the turnaround to measure the improvement. It was agreed that only in-house processing was covered at this stage and that the test would involve all policies at the CPC but only one branch as a model. This model, once proved, could be replicated at other branches.

The test results showed a significant reduction in turnaround:

1. For all non-medical policies: from 64 to 42 days (or 34 percent)
2. For policies of the model branch: from 64 to 27 days (or 60 percent)

The mission sheet goal of 50 percent reduction had been bettered for the combined model branch and CPC. Further analysis of the data revealed other measures which could reduce the turnaround further. Overall reduction reached an amazing 75 percent. Turnaround, which had been pegged at 64 days, was now happening at 99.7 percent on-time delivery in 15 days.

Step 5. Implementing the Ideas

Regular operations with the new system was planned to commence. However, two weeks later it was still not implemented. One of the personnel on the line in CPC had been released by his department for the five-day trial to sit on the line but was not released on a regular basis. The departmental head had not attended the TQM awareness program and therefore did not understand why this change was required.

There were two options – mandate the change or change the mindset to accept the change. Since the latter option produces a robust implementation that will not break down under pressures it was agreed that the group would summarize TQM, the journey and the results obtained in the project so far and also simulate the process with a simple exercise in front of the department head. This session was highly successful and led to the release of the person concerned on a regular basis.

Step 6. Check the Result

The process was run for one month with regular checks. The results obtained were marginally better than the trials conducted in Step 5:

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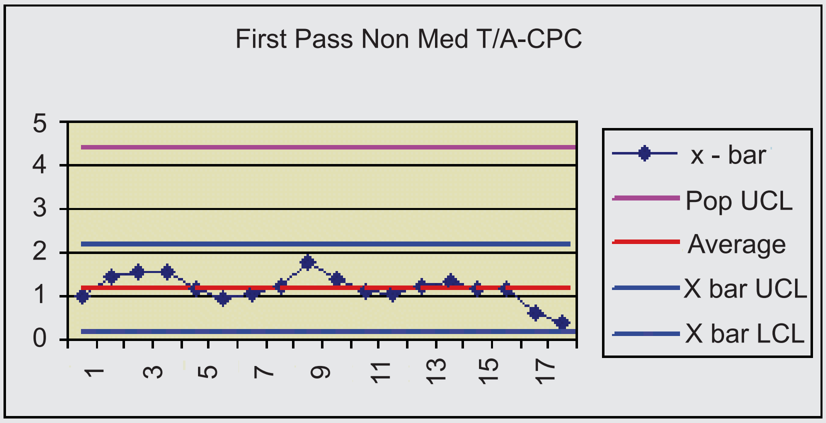
Average—11 days

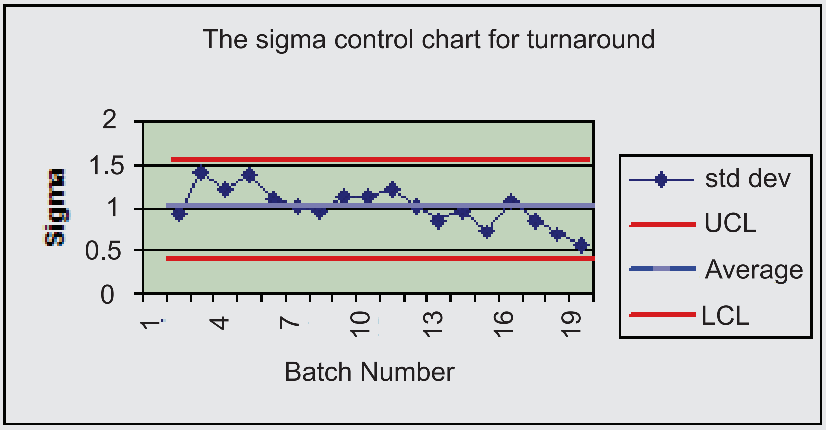
Sigma—9 days

Average + 3 sigma—38 days

Step 7. Standardize Control/Document the Improvement Story

Essentially the in-house processes in two centers of processing – the CPC and one sales branch – had been impacted so far. To make sure that the gains were held, control charts were introduced in both locations. Sample x-bar and sigma-control charts for the CPC are shown below:





- A special grind it-in session was conducted for line personnel to ensure that the control chart was updated every day, and any deterioration was dealt with by finding and killing the root causes of the problems.
- Customer reaction: Sales management and sales agents (internal customers) clearly noticed the difference. For instance one sales manager reported that a customer had received a policy within a week of giving a proposal and was so amazed that he said, "If you give such service I will give you the next policy also!"

- Adoption of a similar process at the CPC and the model branch for medical policies has already reduced the average+3 sigma of turnaround time by 70 percent – from 118 days to 37 days. The corresponding all-India reduction was from 118 days to 71 days – a 60 percent reduction.
- The project objective of 50 percent in the first stage has been achieved.
- A quality improvement story was compiled by the project leader for training and motivating all employees.

Future Actions

Non-medical policies: Goal to reduce turnaround from 42 days to about 15 days.

1. Roll out process to branches to achieve 24 days throughout the country.
2. Minimize rework by analyzing, prioritizing and training sales branches to avoid the causes of rework.
3. Working with the bank to improve the turnaround time of banking checks.
4. Considering processing proposals while check clearance is in progress.

Medical policies: Goal to reduce turnaround from 71 days to about 24 days.

1. Roll out process to branches to reduce turnaround from 71 to 37 days.
2. Streamline the process of medical exam of the client from 37 to 24 days.

Source: *http://www.isixsigma.com/methodology/total-quality-management-tqm/improving-financial-services-through-tqm-case-study/*

6.7 QUALITY REVIEW

The quality review includes the following steps:

Evaluation of Strategy

A strategy is the total pattern of the decisions and actions that position the firm in its environment and are intended to achieve its long-term goals (Slack et al., 1995). Strategies specify how the vision statement will be accomplished. Normally, there are three levels in the strategy hierarchy: Corporate, business, and department strategies (Meredith and Shafer, 1999). Various decision-supporting systems and relevant information available are essential to strategy evaluation, through which firms can seek opportunities to improve their strategies. More importantly, firms should adjust their strategies on the basis of the result of strategy evaluation, thus, keeping competitive advantages in the marketplace (Burrill and Ledolter, 1999).

Evaluation of Overall Business Performance

The objective of implementing TQM is to improve a firm's overall business performance. Therefore, overall business performance should be evaluated regularly.

Otherwise, the effects of implementing TQM remain unclear and more effective TQM implementation approaches cannot be formulated. Implementation depends on the evaluation of overall business performance. In other words, the analysis and investigation of overall business performance can provide adequate input for TQM implementation, identification of improvement areas, and areas caused attention. Overall business performance consists of employee satisfaction, product quality, customer satisfaction, and strategic business performance. The firm can use the latest information on overall business performance to compare with itself (e.g., previous performance, planned objectives), its competitors, and the best practices in the same industry. Through evaluation, firms identify the areas that need action or draw attention (Dale, 1999; Rummler and Brache, 1995).

Evaluation of Departments' Performance

The realization of organizational overall objectives is highly dependent on different functional departments. Therefore, firms do need to regularly evaluate different departments' performance in order to seek opportunities to improve organizational health. Thus, they must develop criteria for evaluating different departments' performance. The criteria should be drawn up objectively, rationally, and fairly. It is imperative that departmental objectives be aligned with the organizational objectives; otherwise, organizational objectives are difficult to achieve. The result of evaluation can be used as the input for subsequent recognition and reward. Note that the major aim of departmental evaluation is to seek improvement opportunities rather than criticism (from the ten interviews).

Evaluation of Employee Performance

Employee performance evaluation is a process by which a firm establishes measures (targets) and evaluates an individual employee's behavior and accomplishments within a finite time period. Employees' performance as a whole affects the success of the firm. Therefore, the firm needs to regularly evaluate employee performance against set targets. Individual targets should be established on the basis of job requirements, potential contributions to organizational objectives, teamwork, working attitudes, etc. The results of employee performance evaluation can serve as input for employees' recognition, reward, dismissal, education, and training. Such information is also valuable for recruiting new employees and improving overall human resource management (from the ten interviews).

Quality Audit

A quality audit is a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives (ISO 8402, 1994). One purpose of a quality audit is to evaluate the need for improvement or corrective action. Through quality audits, problem areas are

identified and necessary measures can then be taken to solve them. Quality audits can be conducted by people within or outside the firm. The outputs of quality audits are very valuable for quality improvement activities (Burrill and Ledolter, 1999; Randall, 1995).

Benchmarking

Benchmarking is the process of understanding one's practice and performance, comparing them against that of competitors or best-in-class firms, learning how they practice and perform, and using that information to improve one's own practice and performance. It is an effective catalyst for change and an effective tool for continuous improvement. Benchmarking can stimulate creativity and provide a stimulus that enables operations to better understand how they should be serving their customers. To conduct benchmarking, firms should know their own situation and identify what and who to benchmark. In order to use benchmarking effectively, the firm should have sufficient information from its competitors or best-in-class organizations. Thus, benchmarking can be conducted (Dale, 1999; Juran and Gryna, 1993; Kolarik, 1995; Slack et al., 1995).

Quality Costs

A firm needs to collect the data of quality-related costs, which it can use to seek improvement opportunities. There are four categories of quality-related costs: Internal failure, external failure, appraisal, and prevention. Internal failure costs are associated with defects found prior to transfer of the products to the customer. External failure costs are associated with defects found after products are shipped to the customer. Appraisal costs are incurred in determining the degree of conformity to quality requirements. Prevention costs are those caused by quality planning, process control, quality audit, supplier quality assessment, and training (Juran and Gyrna, 1993). It should be noted that to have data on quality-related costs is not enough. Without carefully investigating the data of quality costs, actions cannot be effective and chronic quality problems cannot be eliminated. Through analyzing quality costs, more improvement opportunities can be identified (Dale, 1999; Dale and Plunkett, 1991).

Information System

A firm should have an inter-integrated computerized information system, which collects, stores, analyzes, and disseminates information for various specific purposes. Such an information system can manage large amounts of information and provide sufficient information for management to make decisions. Additionally, different departments can share resources through the information network. Thus, communication barriers between different departments are reduced. If information technology remains at a primitive level, an effective information system is impossible. Various information from suppliers, customers, employees, different functional

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departments, data on performance of competitors, and data on "best in class" organizations should be stored in the system. Information system can support the process of decision-making and evaluation. Note that information is gathered so it can be acted on. If it cannot be used, then it is worthless. There is plenty of data in a firm. Only useful information should be collected and stored in the information system. In addition, information stored in the system should be valid, complete, and accurate (Burrill and Ledolter, 1999; Turban et al, 1999).

6.8 RECOGNITION AND REWARDS

Recognition is defined as the public acknowledgment of superior performance of specific activities. Reward is defined as benefits, such as increased salary, bonuses and promotion, which are conferred for generally superior performance with respect to goals (Juran and Gryna, 1993). Public recognition is an important source of human motivation (Deming, 1986). It almost goes without saying that an important feature of any quality improvement program is the showing of due recognition for improved performance by any individual, section, department or division within the firm (Dale and Plunkett, 1990). To effectively support their quality effort, firms must implement an employee compensation system that strongly links quality and customer satisfaction with pay (Brown et al., 1994). Deming (1986) and Ishikawa (1985) identified one source of human motivation at work as social motivation, the energy that comes from cooperation with others on a shared task and the incentive provided by recognition from others. A large majority of firms implementing TQM modify their performance measurement and reward systems so that achievement of specific quality goals can be assessed and rewarded (Hackman and Wageman, 1995). TQM implementation relies increasingly on performance measurement and performance contingent rewards to motivate and control employees. According to the review results by Hackman and Wageman (1995), 85% of TQM firms have developed programs to reward individuals and teams for quality achievements.

DuBrin (1995) stated that punishment is a behavior modification strategy. Punishment is the presentation of an undesirable consequence or the removal of a desirable consequence because of unacceptable behavior, and is regarded as negative motivator. DuBrin (1995) further proposed that a reward and recognition system should be equitable. Workers who achieve the same level of performance should receive comparable rewards. Similarly, workers who fail to obtain certain levels of performance should receive comparable punishment. In this regard, punishment is a special recognition and "reward" for employees who do not perform well. It is important to note that employees' recognition and rewards should be based on equity. Effective recognition and reward activities can stimulate employee commitment to the firm.

A firm's TQM initiative must be supported with a recognition and reward system that encourages and motivates employees to achieve the desired performance. Firms

Check Your Progress

1. Define leadership.
2. What do you mean by empowerment?
3. State the meaning of TQM.
4. What do you mean by cooperative learning?

that are serious about achieving quality and customer satisfaction must integrate these aspects into their recognition and reward system. Ishikawa (1985) suggested that firm-wide gain-sharing or profit-sharing programs can appropriately be used to recognize and reward collective excellence. Excellent employee suggestions should be financially rewarded in order to encourage employee participation. The forms of recognition can be a praise letter, an oral praise, award ceremony, moral award, publicly presenting successful working experiences (Zhang, 2000a). Mann and Kehoe (1994) suggested that working condition improvement be used to recognize employee quality improvement efforts. Cherrington (1995) stated that the forms of reward can be merit pay, piece-rate incentives, team and group incentives, skill based pay and pay-for-knowledge, suggestion system, profit sharing, salary increase, and bonus scheme.

Recognition and Reward Program

Firms should institute a serious recognition and reward program. First, the recognition and reward must be consistent with organizational values and objectives. If individual or team efforts cannot contribute to the realization of the overall organizational objectives, they cannot be recognized and rewarded. Therefore, objectives of individuals or teams need to be continuously reviewed and updated. Second, criteria should be objective and measurable; otherwise, it is not easy to ensure that the recognition and reward can be conducted fairly. Third, the recognition and reward should be meaningful and fit the organizational culture. Otherwise, it is useless. Fourth, the program should be approved by the workers' congress. Fifth, once the program is approved, it should be strictly implemented. Otherwise, recognition and reward activities cannot effectively stimulate employee commitment, enthusiasm, and creativity. Finally, recognition and reward can be provided at several levels: Individual, team, department, or business unit (Burrill and Ledolter, 1999; Cherrington, 1995; Ishikawa, 1985; Kolarik, 1995).

Working Environment Improvement

The firm needs to continuously improve working conditions in order to recognize employee quality improvement efforts. For example, a clean working environment, a cordial and friendly atmosphere, a factory canteen, showers, and sports provisions are important ways to show recognition for employees' contributions to the firm. Firms also need to maintain a work environment conducive to the wellbeing, morale, and growth of all employees. The firm should improve workplace health, safety, and ergonomic factors; consider each person as an individual, a resource to benefit from rather than a commodity to be used. The firm should try its best to reduce employees' working strains and protect their health by providing suitable equipment, devices, or tools (Deming, 1986).

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Salary Promotion

Salary level is an important factor affecting employee satisfaction and contributions. The salary range should be sufficiently wide to allow for adequate differentiation of salary based on performance. The most important requirement for an effective merit pay incentive program is to measure performance against clearly defined objectives. However, other aspects of employees' performance should also be considered, such as attendance, positive work attitudes, or initiatives. The firm should pay more for employees who have demonstrated knowledge, skills, and performance. Highly skilled employees must have high salaries; otherwise, their potential cannot be fully exercised. Salary promotion should be fair and rational. Otherwise, problems can be created. In a word, the firm should carry out diverse distribution forms with "to each according to his work" as the main form, and establish an effective incentive mechanism (Cherrington, 1995).

Bonus Scheme

In order to encourage employees (teams, departments, or business units) to make more contributions to the firm, a bonus scheme should be implemented. A bonus scheme offers monetary rewards to employees for meeting set targets. To ensure an effective bonus scheme, it is very essential to set up targets for different employees (teams, departments, or business units). These targets may be related to quality, yields, productivity, customer satisfaction, profits, and other performance measures. Note that such defined targets should be aligned with the overall organizational business objectives. The success or failure of a bonus scheme is highly dependent on the defined targets. Therefore, great attention should be given to identifying major factors impacting the effect of a bonus scheme. The firm should move toward more performance-oriented pay. The principle of "distribution according to work" should be thoroughly implemented (Cherrington, 1995).

Position Promotion

Position promotion must be based on, for example, employees' capabilities, skills, performance, and contributions to the firm, and must not be based on the employees' personal relationships with the director of the firm. An effective and rational position promotion mechanism should be established. If position holders cannot fulfill their duties due to lack of skills, capabilities, performance, or support from their colleagues, more qualified personnel should take over. Every employee in the firm can see the hope of promotion opportunities if he or she performs well. Thus, employees' enthusiasm, creativity, and active participation are encouraged. In a word, the appointments and removals of managerial personnel must be done according to the principle of equal competition, fairness, and rationality (from the ten interviews).

Moral Award

Moral award can be used to recognize the quality performance of employees or teams. It may take the form of thank-you note, oral praise, a letter of praise, sending an employee to a seminar or a conference, presentation of individual or team achievements, award certification, award ceremony, etc. Note that moral award is more effective with intellectuals than with manual line employees. Moral award should be fair and rational; otherwise, negative effects are created (from the ten interviews).

Penalty

In order to intensify the firm's management and establish a strict responsibility system at different levels and stages, the firm needs to have various kinds of rules and regulations, which can force employees to abide by work discipline. Evidence shows that penalties are effective in enhancing employees' commitment and responsibilities, adhering to various regulations, and sticking to work discipline. To have an effective penalty scheme the firm should set up penalty criteria, which should be approved by the workers' congress. More importantly, the firm should implement the penalty scheme seriously and impartially. Otherwise, penalty cannot be effective and negative effects can be created. Note that penalties are special recognition and "reward" activities for employees who cannot perform their work well, or violate the firm's rules and regulations (from the ten interviews).

6.9 QUALITY AWARDS

Worldwide, there are several Quality Awards, such as the Deming Prize in Japan (1996), the European Quality Award in Europe (1994), and the Malcolm Baldrige National Quality Award in the United States of America (1999). The broad aims of these awards are described as follows (Ghobadian and Woo, 1996):

- Increase awareness of TQM because of its important contribution to superior competitiveness;
- Encourage systematic self-assessment against established criteria and market awareness simultaneously;
- Stimulate sharing and dissemination of information on successfully deployed quality strategies and on benefits derived from implementing these strategies;
- Promote understanding of the requirements for the attainment of quality excellence and successful deployment of TQM;
- Encourage firms to introduce a continuous improvement process.

Each award model is based on a perceived model of TQM. The award models do not focus solely on either product or service perfection or traditional quality

management methods, but consider a wide range of management activities, behavior and processes that influence the quality of the final offerings. They provide a useful audit framework against which firms can evaluate their TQM implementation practices, seek improvement opportunities, and the end results.

6.9.1 Japanese Deming Award

The Deming Prize was established by the Board of Directors of the Japanese Union of Scientists and Engineers in 1951. Its main purpose is to spread the quality gospel by recognizing performance improvements flowing from the successful implementation of firm-wide quality control based on statistical quality control techniques (Ghobadian and Woo, 1996). The Deming Prize proved an effective instrument for spreading TQM philosophy throughout the Japanese industries. There are ten primary elements in the Deming Application Prize (1996), as well as a checklist that is used to evaluate the performance of senior executives. This checklist emphasizes the importance of top management's active participation in quality management activities and understanding of the main requirements of quality improvement programs. It is also provides senior executives with a list of what they need to do. The primary elements in the Deming Application Prize and the checklist used to evaluate senior executives are listed below:

1. **Policies**
   - Quality and quality control policies and their place in overall business management;
   - Clarity of policies (targets and priority measures);
   - Methods and processes for establishing policies;
   - Relationship of policies to long- and short-term plans;
   - Communication (deployment) of policies, and grasp and management of achieving policies;
   - Executives' and managers' leadership.
2. **Organization**
   - Appropriateness of the organizational structure for quality control and status of employee involvement;
   - Clarity of authority and responsibility;
   - Status of interdepartmental coordination;
   - Status of committee and project team activities;
   - Status of staff activities;
   - Relationships with associated companies (group companies, vendors, contractors, sales companies, etc.).
3. **Information**
   - Appropriateness of collecting and communicating external information;
   - Appropriateness of collecting and communicating internal information;

- Status of applying statistical techniques to data analysis;
- Appropriateness of information retention;
- Status of utilizing information;
- Status of utilizing computers for data processing.

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4. Standardization

- Appropriateness of the system of standards;
- Procedures for establishing, revising and abolishing standards;
- Actual performance in establishing, revising and abolishing standards;
- Contents of standards;
- Status of utilizing and adhering to standards;
- Status of systematically developing, accumulating, handing down and utilizing technologies.

5. Human resources

- Education and training plans and their development and results utilization;
- Status of quality consciousness, consciousness of managing jobs, and understanding of quality control;
- Status of supporting and motivating self-development and self-realization;
- Status of understanding and utilizing statistical concepts and methods;
- Status of QC circle development and improvement suggestions;
- Status of supporting the development of human resources in associated companies.

6. Quality assurance

- Status of managing the quality assurance activities system;
- Status of quality control diagnosis;
- Status of new product and technology development (including quality analysis, quality deployment and design review activities);
- Status of process control;
- Status of process analysis and process improvement (including process capability studies);
- Status of inspection, quality evaluation and quality audit;
- Status of managing production equipment, measuring instruments and vendors;
- Status of packaging, storage, transportation, sales and service activities;
- Grasping and responding to product usage, disposal, recovery and recycling;
- Status of quality assurance;

- Grasping of the status of customer satisfaction;
- Status of assuring reliability, safety, product liability and environmental protection.

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7. **Maintenance**
   - Rotation of management (PDCA) cycle control activities;
   - Methods for determining control items and their levels;
   - In-control situations (status of utilizing control charts and other tools);
   - Status of taking temporary and permanent measures;
   - Status of operating management systems for cost, quantity, delivery, etc.;
   - Relationship of quality assurance system to other operating management systems.
8. **Improvement**
   - Methods of selecting themes (important activities, problems and priority issues);
   - Linkage of analytical methods and intrinsic technology;
   - Status of utilizing statistical methods for analysis;
   - Utilization of analysis results;
   - Status of confirming improvement results and transferring them to maintenance/control activities;
   - Contribution of QC circle activities.
9. **Effects**
   - Tangible effects (such as quality, delivery, cost, profit, safety and environment);
   - Intangible effects;
   - Methods for measuring and grasping effects;
   - Customer satisfaction and employee satisfaction;
   - Influence on associated companies;
   - Influence on local and international communities.
10. **Future plans**
    - Status of grasping current situations;
    - Future plans for improving problems;
    - Projection of changes in social environment and customer requirements and future plans based on these projected changes;
    - Relationships among management philosophy, vision and long-term plans;
    - Continuity of quality control activities;
    - Concreteness of future plans.

The checklist used to evaluate the performance of senior executives is listed as follows:

1. **Understanding**
    - Are the objectives of quality control and enthusiasm introduction and promotion clearly defined and well understood?
    - How well do they understand quality control, quality assurance, reliability, product liability, etc.?
    - How well do they understand the importance of the statistical way of thinking and the application of quality control techniques?
    - How well do they understand QC circle activities?
    - How well do they understand the relationship of quality control and the concepts and methods of other management activities?
    - How enthusiastic are they in promoting quality control? How well are they exercising leadership?
    - How well do they understand the status and the characteristics of their company's quality and quality control?
2. **Policies**
    - How are quality policies and quality control policies established? Where and how do these policies stand in relation to overall business management?
    - How are these policies related to short- and long-term plans?
    - How are these policies deployed throughout the company for their achievement?
    - How do they grasp the status of policy achievement? Are they taking appropriate corrective actions when needed?
    - How do they grasp priority quality issues (priority business issues)? Do they make effective use of diagnostic methods such as top management diagnosis?
    - How well are targets and priority measures aligned with policies?
    - What kind of policies do they employ for establishing cooperative relationships with associated companies?
3. **Organization**
    - How the company is organized and managed so that human resources can effectively and efficiently practice quality control?
    - How are the authorities and responsibilities in the organization established?
    - Is the allocation of human resources suitable for the organization?
    - How do they strive to make employees happy and satisfied?
    - How do they grasp and evaluate employees' capability and motivation levels?

- How do they strive for interdepartmental cooperation? How do they utilize committees and project teams?
- How do they relate to associated companies?

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4. **Human resources**
   - How clear is the philosophy for hiring, developing and utilizing human resources?
   - How appropriate are the employee education and training plans? Are the necessary budget and time allocated?
   - How do they communicate the policies for quality control education and training and how do they grasp the status achieving their policies?
   - How do they provide education and training specific to the company's business needs?
   - How well do they understand the importance of employee self- and mutual development?
   - How do they support this effort?
   - How do they strive to develop QC circle activities?
   - How interested are they in developing human resources in associated companies?
5. **Implementation**
   - What kind of measures do they have for the evaluation, and effective and efficient implementation, of quality control?
   - How well is the overall coordination of quality control and other management systems?
   - How do they grasp the status of improvement in the business processes and the individual steps of these processes so as to provide products and services that satisfy the customer needs? Are they taking necessary corrective actions?
   - How well are the systems for developing new products and services, new technologies and new markets established and managed?
   - How well are the necessary resources secured and allocated for establishing and operating management and information systems?
   - How do they grasp the effects and contributions of quality control to the improvement of business performance?
   - How do they evaluate their employees' efforts?
6. **Corporate social**
   - Is the company structured to ensure appropriate profits for a long time?
   - How well do they regard employee well-being (wage levels, working hours, etc.)?
   - How well do they regard employee self-realization?

- How well do they strive for co-existence and co-prosperity with associated companies?
- How well does the company contribute to the local community?
- How well does the company exert efforts to protect the environment?
- How well does the company positively impact the international community?

7. **Future visions**
   - How do they assure the continuity of, and future plans for, quality control?
   - How do they anticipate and cope with changes in surrounding business environment and progress in science and technology?
   - How do they grasp and cope with changes in customer requirements?
   - How do they consider their employees and help them achieve happiness and satisfaction?
   - How do they consider and manage relationships with associated companies?
   - How do they plan for the future to cope with the items above?
   - How do they utilize quality control to achieve the future plans?

6.9.2 US Malcolm Baldrige National Quality Awards

In 1987, the US Congress passed the Malcolm Baldrige National Quality Improvement Act, and thus established an annual quality award in the US. The aim of the award is to encourage American firms to improve quality, satisfy customers, and improve overall firms' performance and capabilities. The model framework can be used to assess firms' current quality management practices, benchmark performance against key competitors and world-class standards, and improve relations with suppliers and customers. The Malcolm Baldrige National Quality Award model framework (1999) is listed as follows:

1. **Leadership**
   (a) Organizational leadership
   (b) Public responsibility and citizenship
2. **Strategic planning**
   (a) Strategy development
   (b) Strategy deployment
3. **Customer and market focus**
   (a) Customer and market knowledge
   (b) Customer satisfaction and relationships

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4. **Information and analysis**
   (a) Measurement of organizational performance
   (b) Analysis of organizational performance
5. **Human resource focus**
   (a) Work systems
   (b) Employee education, training, and development
   (c) Employee well-being and satisfaction
6. **Process management**
   (a) Product and service processes
   (b) Support processes
   (c) Supplier and partnering processes
7. **Business results**
   (a) Customer focused results
   (b) Financial and market results
   (c) Human resource results
   (d) Supplier and partner results
   (e) Organizational effectiveness results

6.9.3 The European Model for TQM

The European Quality Award was officially launched in 1991. The primary purpose of the award is to support, encourage, and recognize the development of effective TQM by European firms. The model of the European Quality Award is divided into two parts, Enablers and Results. The enablers are leadership, people management, policy & strategy, resources, and processes. These five aspects steer the business and facilitate the transformation of inputs to outputs. The results are people satisfaction, customer satisfaction, impact on society, and business results (the measure of the level of output attained by the firm). The European Quality Award model (1994) consists of nine primary elements, which are further divided into a number of secondary elements. The primary and secondary elements are listed below:

1. **Leadership**
   - Visible involvement in leading total quality;
   - A consistent total quality culture;
   - Timely recognition and appreciation of the effects and successes of individuals and teams;
   - Support of total quality by provision of appropriate resources and assistance;
   - Involvement with customers and suppliers;
   - Active promotion of total quality outside the organization.

2. **Policy and strategy**
   - How policy and strategy are based on the concept of total quality;
   - How policy and strategy are formed on the basis of information that is relevant to total quality;
   - How policy and strategy are the basis of business plans;
   - How policy and strategy are communicated;
   - How policy and strategy are regularly reviewed and improved.
3. **People management**
   - How continuous improvement in people management is accomplished;
   - How the skills and capabilities of the people are preserved and developed through recruitment, training and career progression;
   - How people and teams agree on targets and continuously review performance;
   - How the involvement of everyone in continuous improvement is promoted and people are empowered to take appropriate action;
   - How effective top-down and bottom-up communication is achieved.
4. **Resources**
   - Financial resources;
   - Information resources;
   - Material resources and fixed assets;
   - The application of technology.
5. **Processes**
   - How processes critical to the success of the business are identified;
   - How the organization systematically manages its processes;
   - How process performance measurements, along with all relevant feedback, are used to review processes and to set targets for improvement;
   - How the organization stimulates innovation and creativity in process improvement;
   - How the organization implements process changes and evaluates the benefits.
6. **Customer satisfaction.**
7. **People satisfaction.**
8. **Impact on society.**
9. **Business results.**

6.9.4 Indian Golden Peacock National Quality Awards

The Golden Peacock National Quality Award, named after India's national bird the "Peacock", is awarded annually. The award winners may use the Golden Peacock

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National Quality Award logo on their printed and promotional material for the next 3 years. Selected organisations may be given a commendation card. The Golden Peacock National Quality Award will be given separately for manufacturing and service organisations in different sectors under the following categories :

Categories

- Large Enterprises (Annual Turnover ₹ 300 crores & above)
- Medium and Small Enterprises (Annual Turnover less than ₹ 300 crore)

Special Categories

- Education, Training, Research and Development, Testing & Inspection
- Service Sector covering Tourism, Transport, Couriers, Hotels & Hospitality, Healthcare,
- Telecommunication, Professional Consultancies, Financial Institutions.
- Government Organisations, Undertakings & Services.

Eligibility

Manufacturing or Service organizations or parts of organizations (self accounting profit centres) operating in India may participate in the Golden Peacock National Quality Award. The decisive factor for eligibility is that the operations of the applicant must reasonably correspond to the award criteria and which can be verified at the time of evaluation. The operations of the applicant must be carried out independently, meaning that responsibilities, authorities, results, etc. are clearly defined. This must be documented, for example, in the annual report, organisation plan or equivalent.

Rules & Regulations

- GPAS reserves the right to alter the award scheme.
- GPAS reserves the right to award more than one trophy each year and also to withhold awards if the required standard is not met.
- GPAS accepts no liability for any loss resulting from the disclosure of information concerning an entry, though all reasonable precautions will be taken to maintain secrecy.
- GPAS cannot undertake to return documents or supplementary material submitted with an entry.
- Few selected award winners may also be invited to make a brief presentation in the ensuing "World Congress on Total Quality" to share their experiences.
- The decision of the Chairman of the Jury, on the recommendations of the Panel of Judges is final and no appeal or correspondence will be entertained.

Core Values

The Golden Peacock National Quality Award is based on 13 core values and concepts that are characteristic of successful organisations.

The evaluation of your organisation is based on how and to what extent the core values and concepts permeate your operations and provide the foundation for integrating key business requirements within a results-oriented frame-work.

1. **Customer-Driven Quality:** The objective of all organisations is to satisfy their customers' stated or implied needs. All employees must consider it their task to satisfy the needs of both their external and internal customers. Customer is the final arbiter who takes into account the issues that influence royalty.
2. **Committed Leadership:** In order to create a system that focuses on the customer, personal, active and visible commitment is required from every manager. The leadership must set the direction and define and follow up the goals by creating opportunities for the employees to achieve the same. Leaders develop the organisations culture, and drive the organisation towards excellence.
3. **Participation by Everyone:** A prerequisite for a successful organisation is that every employee feels that he/she is trusted by the organisation to perform and develop his or her tasks. Consequently, everyone must be aware of the goals, have the means to attain them and be aware of the results achieved.
4. **Competence Development:** Skilled employees are a prerequisite for the success and competitiveness of an organization. Therefore every employee should have the opportunity for improvement and further development in a way that benefits both the individual and the organisation.
5. **Long-Range Perspective:** The organisation must focus on long-term development and competitiveness. A sustainable process of improvement leads to improved productivity and effectiveness, a better environment, increased customer satisfaction and long-range profitability.
6. **Social Responsibility:** Every organization has a public responsibility that extends beyond laws and regulations. The organization and the employees must see their processes, products and services as part of a much broader totality and actively contribute to improving society and the environment.
7. **Process Orientation:** The activities of the organisation should be seen as processes that create value for the customers. Process orientation stimulates an analysis and improvement in the work flow and working of the organization and lays the foundation for customer-oriented operational development. Decisions must be based on reliable facts and figures.

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8. **Prevention:** It pays to prevent faults from occurring and eliminate risks in processes, goods and services. It is also vital to involve customers and suppliers in this process.
9. **Continuous Improvement:** Competitiveness requires continuous improvements and renewal of all aspects of the business. The basis of this is a methodical process of improvement that permeates all level of the organization and an organizational culture that stimulates creative suggestions and new ideas.
10. **Learning From Others:** The organization must acquire knowledge in all areas about what can be achieved. This requires comparisons to be made with those that can be considered to be the best in a certain process, regardless of the trade or sector they happen to belong to.
11. **Faster Response:** In all businesses, shorter response times and more rapid reactions to the needs of the customers are decisive. This applies to development, production and delivery of goods and services, as well as to administrative processes.
12. **Partnership:** Partnership development is the key to success in today's business. It is essential that, through co-operation, different skill areas are combined among staff and among customers, suppliers, partners, owners and principals.
13. **Results Focus:** The organisations performance measurements need to focus on key results balancing and satisfying the interests of all stake-holders

The Criteria - An Overview

Categories / Items	Point Values
1. Organizational Leadership	120
• Senior Leadership - Commitment & Involvement	50
• Total Quality Culture	40
• Responsibilities towards Society	30
2. Strategic Planning	80
• Strategic Planning Process	20
• Customer & Market Focus	20
• Innovation & Growth	20
• Strategy Development	20
3. Information Management	80
• Performance Measures & Data Integration	20

• Selection and use of Comparative Information including Competitive Data	20
• Information Analysis and Use	40
4. Human Resource Management	100
• H.R. Policies and Strategies	25
• Skills and Competency Enhancement	25
• Organisation Design and Self-directed Responsibilities	25
• Reward, Recognition & Encouragement	25
5. Process Management	120
• Process Design and Management	20
• Development of Products/Services	20
• Development of Process	20
• Delivery of Products/Services, Feedback & Improvement	20
• Handling Complaints & Customer Relationship Management	20
• Supplier Selection and Management	20
6. Employees Satisfaction	100
• Work Environment	20
• People Involvement & Commitment	20
• People Satisfaction Determination	20
• People Satisfaction Results	40
7. Customer Satisfaction	150
• Customer Commitment	30
• Customer Complaints	30
• Customer Satisfaction Determination	30
• Customer Satisfaction Results	60
8. Impact on Society	100
• Protection of Environment	50
• Benefits to Society	50
9. Business Results	150
• Market-related Results	50
• Operating Performance-related Results	50
• Financial Results	50

NOTES

Case Study: Improving Medical Bill Review Cycle Time

When the clock is ticking in time-bound, customer-sensitive operations, using Lean Six Sigma can be a smart move toward achieving operational excellence and customer satisfaction. In this case study, one large insurance company executed a Lean Six Sigma project to cut operational costs for property and casualty (P&C) insurance claims and improve customer satisfaction. The project was completed in the medical bill review process for personal injury protection (PIP) and medical payment (med pay) auto insurance coverage. PIP and med pay are part of the auto insurance coverage that pays for medical expenses, funeral expenses, and, in some cases, lost wages and other damages resulting from an automobile accident for the insured customers and others riding in a car or walking.

Define

The insurance company outsourced its PIP and med pay bill review process to a leading medical bill review company. The medical bill review process was laden with repetitive and inefficient handoffs between the insurance company and its outsourcing partner, which led to loss of money and time. Delays in the bill review process also caused customer dissatisfaction, which manifested in a high volume of inbound phone calls as customers and medical providers sought to understand the status of bill payment. Also, delays beyond 30 days in the medical bill review process lead to payment of interest, fines and penalties, as there are 30 states (within the United States) that have legal regulation for a bill review cycle time of 30 days.

The goal of the project was to reduce the average cycle time of the PIP and med pay bill review process from 28 days to 15 days. The targeted benefit was an annual cost saving of $1 million, based on savings in partner bill review expenses, adjusting expenses, loss cost, cost of law suit avoidance and cost of non-value-added activities.

Measure

In order to measure improvement, the team defined the key output metric for the PIP and med pay bill review process (Table 6.1).

Table 6.1: Operational Definition of Output Metric

Key Output Metric	Definition	Measurement Unit	Specification Limits
Process cycle time	Elapsed time between start of bill review process until decision	Days	Upper (USL) = 30 days for 30 selected states, Lower (LSL) = 0 days

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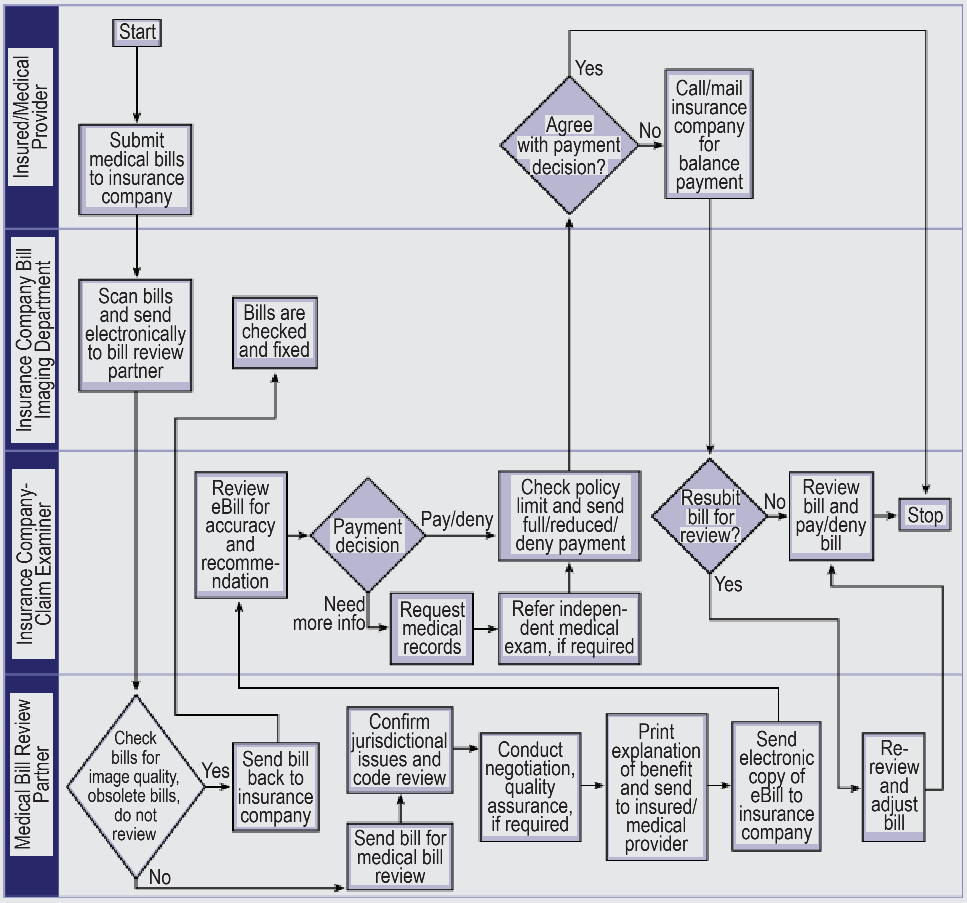


Fig. 6.3: PIP and Med Pay Bill Review As-is Process

There are 30 states that require a 30-day-or-less bill review cycle time. Figure 6.4 shows that on average, bill review cycle time is 28 days for all states. For states where there is no legal requirement of 30 days, bill review cycle time is 70 days.

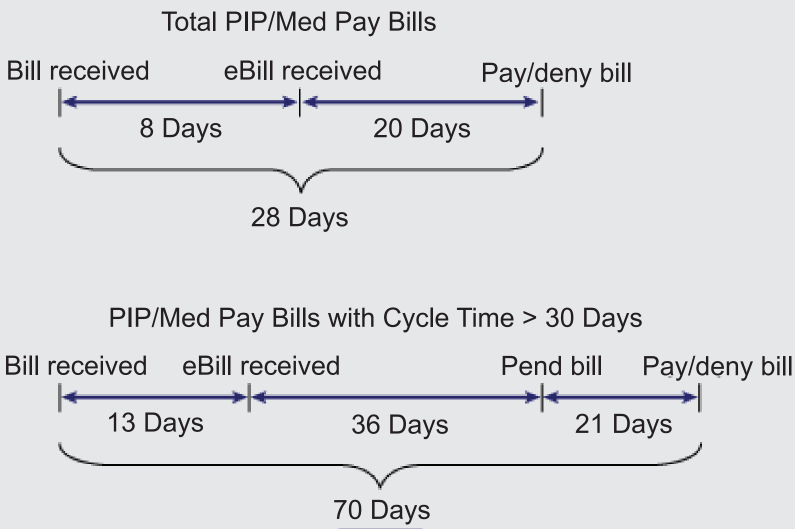


Fig. 6.4: Average Process Cycle Time in States With and Without Time Requirements

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Analyze

The team created a fishbone diagram to outline potential causes for bill review cycle time greater than 30 days related to the machines, methodology, providers, measurements, partner operations and internal operations involved.

They also conducted hypothesis testing, which confirmed that the 30-day bill review response time requirement does impact actual turnaround time (Figure 6.5).

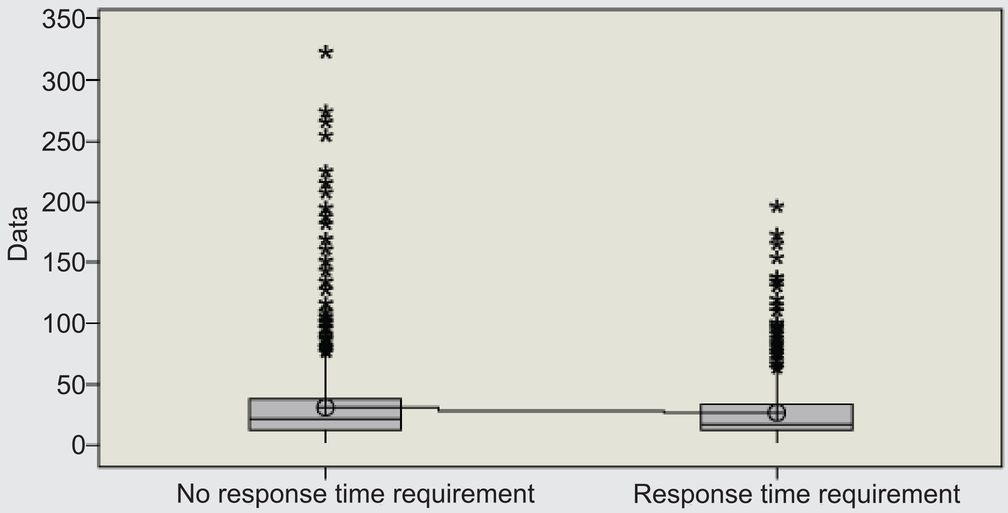


Fig. 6.5: No Response Time Requirement vs. Response Time Requirement

Two-sample T-test for states with no response-time requirement vs. states with response-time requirement.

	N	Mean	St.Dev	SE Mean
No response-time requirement	1000	31.6	33.9	1.1
Response-time requirement	987	27.3	25.4	0.81

Difference = mu (No response-time requirement) – mu (Response time requirement)

Estimate for difference: 4.22571

95% CI for different (1.592888, 6.855853)

T-test of difference = 0 (vs not =). T-value = 3.15 P-value = 0.002

DF = 1853

Conclusion: 30-day response-time requirement does impact bill review cycle time.

Improve

Next, the team conducted process value analysis to identify the non-value-added activities contributing to delays in the bill review process (Table 6.2).

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Table 6.2: Wasteful Activities and Solutions

Non-value-added Activities	Solution Snapshot	Projected Savings
Redundant partner review of bills – Certain bills were denied for payment due to unreasonable, unrelated and unnecessary causes at the end of the bill review of process	Bills should come to the examiner first to check policy limits, coverage, deductible, relatedness and need for medical records, and then be emailed to the bill review partner for further review. Adjuster should provide reasons for overriding	
and fees for such bills should not be paid to bill review partner.	$50,000	
Re-review of bills due to lack of information	Medical provider should pay the processing fee for errors in the bill. They should also be charged for medical records request fees for not sending medical records along with bills for those states where medical records are mandated.	$230,000
Untimely payment, denial of bills due to lack of metrics for turnaround time	Track compliance of partners and insurance company with bill review cycle time service-level agreement. USL for bill review cycle time needs to be set to 30 days for all states. Twenty-one days should be set as the target for average bill review cycle time.	$47,000
Inconsistencies in bill review for same medical treatment at a given time at the same physical location	Identify medical treatment codes where the variation is observed. Complete a gage R&R check for medical bill review regularly tp rectify inconsistencies in partner medical bill review process. Add reward/penalty clauses in the partner's contract for handling inconsistencies in partner's recommendations that lead to lawsuits.	$330,000

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Bill review summary called explanation of benefits (EOB) and payment check sent are separately, leading to confusion and calls from medical providers and customers.	Automatic payment – EOB and check printed in house within insurance company.	$129,000
EOB unnecessarily sent for bills paid in full. Effort spent on unnecessary tasks leads to loss of bill review throughput capacity.	Printing and mailing EOB to be stopped for bills paid in full.	$40,000
Partner unnecessarily reviewing bills from non-partner bill review states: MD, AL, LA, MO, MS, OK, TN	Proper communication mechanism to be established between unit managers, imaging and scanning area and medical management team on a standard frequency regarding the states that will not send bills to partner.	$30,000
Paying flat bill review fees per bill	Contract to be revised with partner to pay bill review fees per line item instead.	$340,000
	Grand total:	$1.619 MM

Figure 6.4 shows the PIP and med pay bill review to-be process (proces steps marked in red are the changes to as-is proces).

Control

The team tested the new process with pilots in a few states initially, and rolled out a detailed control plan to all states after the success of the pilot.

Bill review cycle time was reduced from 28 days to 15 days by controlling the items causing variation and delays. This helped the company avoid paying $1.6 million in interest, penalties, fines and law suit fees.

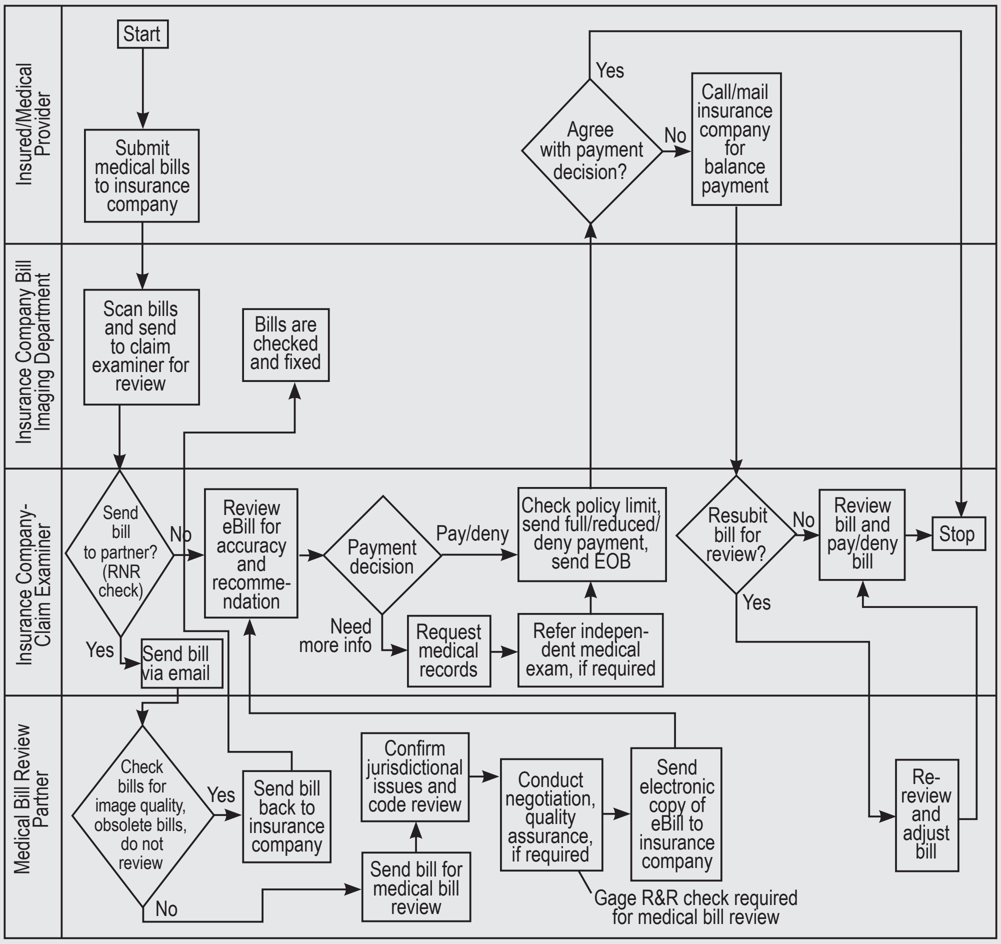


Fig. 6.6: Bill Review To-be Process

Source: *http://www.isixsigma.com/industries/healthcare/case-study-improving-medical-bill-review-cycle-time/*

6.10 SUMMARY

- Total Quality Management (TQM) leadership refers to top managers of an organization responsible for implementing a system to improve customer satisfaction.
- Leadership behaviours lead to highly motivated staff. Subordinates rely upon the leadership skills of their superiors to show them how to achieve their needs of motivation, rewards and ability to perform their allocated tasks.
- A preliminary step in TQM implementation is to assess the organization's current reality. Relevant preconditions have to do with the organization's history, its current needs, precipitating events leading to TQM, and the existing employee quality of working life.

NOTES

Check Your Progress

Fill in the Blanks

5. …………….. is defined as the public acknowledgment of superior performance of specific activities.
6. …………… must be based on, for example, employees' capabilities, skills, performance, and contributions to the firm, and must not be based on the employees' personal relationships with the director of the firm.
7. ………… is defined as benefits, such as increased salary, bonuses and promotion, which are conferred for generally superior performance with respect to goals (Juran and Gryna, 1993).
8. A ……….. offers monetary rewards to employees for meeting set targets.

NOTES

- Implementing total quality management (TQM) is best done as a revamping or overhaul of the culture of a business.
- The customer defines the purpose of the organization and every process within it. Success means striving to become the best supplier of your particular products and services in the minds of those customers.
- To ensure customer satisfaction, experts recommend prompt response to customer communications, whether by phone, mail, email, or Twitter.
- A common success theme of operations strategy lies on manufacturers' choice of emphasis among key capabilities or competitive advantages.
- The need for a strategy arises because choices are not obvious. Better quality at any price is a naïve strategy which recently turned out to be right because the cost of quatiy has been grossly understated and the benefits of quality entirely unaccounted for.
- A strategy is the total pattern of the decisions and actions that position the firm in its environment and are intended to achieve its long-term goals (Slack et al., 1995).
- A quality audit is a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives (ISO 8402, 1994).
- Recognition is defined as the public acknowledgment of superior performance of specific activities. Reward is defined as benefits, such as increased salary, bonuses and promotion, which are conferred for generally superior performance with respect to goals (Juran and Gryna, 1993).
- Worldwide, there are several Quality Awards, such as the Deming Prize in Japan (1996), the European Quality Award in Europe (1994), and the Malcolm Baldrige National Quality Award in the United States of America (1999).
- The Deming Prize was established by the Board of Directors of the Japanese Union of Scientists and Engineers in 1951. Its main purpose is to spread the quality gospel by recognizing performance improvements flowing from the successful implementation of firm-wide quality control based on statistical quality control techniques (Ghobadian and Woo, 1996).
- In 1987, the US Congress passed the Malcolm Baldrige National Quality Improvement Act, and thus established an annual quality award in the US. The aim of the award is to encourage American firms to improve quality, satisfy customers, and improve overall firms' performance and capabilities.
- The Golden Peacock National Quality Award, named after India's national bird the "Peacock", is awarded Annually. The award winners may use the Golden Peacock National Quality Award logo on their printed and promotional material for next 3 years.

6.11 KEY TERMS

- **Leadership:** Leadership is the ability to inspire confidence and support among those needed to achieve organizational goals.
- **Total Quality Management (TQM) leadership:** Total Quality Management (TQM) leadership refers to top managers of an organization responsible for implementing a system to improve customer satisfaction.
- **Cooperative learning:** Cooperative learning refers to the mechanisms through which partners can share knowledge, information, and resources. Organizations develop cooperative relationships through creating a learning environment so that they can facilitate mutual learning.
- **Strategy:** A strategy is the total pattern of the decisions and actions that position the firm in its environment and are intended to achieve its long-term goals.
- **Quality audit:** A quality audit is a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.
- **Benchmarking:** Benchmarking is the process of understanding one's practice and performance, comparing them against that of competitors or best-in-class firms, learning how they practice and perform, and using that information to improve one's own practice and performance.

6.12 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Leadership is the ability to inspire confidence and support among those needed to achieve organizational goals.
2. Empowerment is the process of delegating decision-making authority to lower levels within the firm.
3. Total Quality Management (TQM) as a management tool needs to radically rethink the way in which an organization is organised and performs its functions.
4. Cooperative learning refers to the mechanisms through which partners can share knowledge, information, and resources. Organizations develop cooperative relationships through creating a learning environment so that they can facilitate mutual learning.
5. Recognition.
6. Position promotion.
7. Reward.
8. Bonus scheme.

6.13 QUESTIONS AND EXERCISES

NOTES

Short Answer Questions

1. Define leadership.
2. What are the key approaches of Total Quality Management implementation?
3. State the key roadblocks in Total Quality Management implementation.
4. State the meaning of customer satisfaction.
5. How to maintain quality competitive advantage?
6. How quality can create values for the company?
7. Briefly explain the key quality awards.

Long Answer Questions

1. Discuss the concept of Total Quality Management leadership.
2. What are the key aspects of Total Quality Management implementation?
3. What are the key essentials of implementing Total Quality Management?
4. How to maintain competitive advantage in Total Quality Management?
5. Discuss the role of core competencies and strategic alliance for ensuring quality.
6. How to conduct an effective quality review?
7. Discuss the major quality awards at national and international level.

MODEL QUESTION PAPER

DISTANCE EDUCATION

MBA Degree Examination

Fourth Semester

Quality Management

NOTES

Time: Three hours *Maximum: 100 Marks*

PART A **(5 × 8 = 40 Marks)**

Answer any FIVE Questions

1. Define quality. State the difference between customer satisfaction and customer delight.
2. Discuss the contribution of key quality gurus such as Juran, Deming and Crosby.
3. What are the key elements and significance of quality process?
4. Discuss the role of MNCs in emergence of global quality.
5. Discuss the concept of quality system. What are the key differences between TQC and TQM?
6. Define JIT. What are the key elements and features of JIT?
7. What are the key elements of TQM? Discuss.
8. Discuss the role of core competencies and strategic alliance for ensuring quality.

PART B **(4 × 15 = 60 Marks)**

Answer any FOUR Questions

9. Discuss the concept of quality as customer delight and meeting standards.
10. Discuss the meaning and importance of Zero Defect Manufacturing.
11. What are the key tools and techniques for quality planning?
12. Productivity is the relationship between a given amount of output and the amount of input needed to produce it. How productivity is connected with quality?
13. What are the key elements of Total Quality Control (TQC)?
14. Define global standards. What is the ISO 9000 series?
15. Discuss the major quality awards at national and international level.